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Langley Research Center

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  Hanover, MD 21076-1320

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

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- NASA, NASA contractor, and NASA grantee reports
- Reports issued by other U.S. Government agencies, domestic and foreign institution, universities, and private firms
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- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
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Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20100019163 NASA Langley Research Center, Hampton, VA, USA

Development of the NTF-117S Semi-Span Balance

Lynn, Keith C.; May 10, 2010; 16 pp.; In English; 7th International Symposium on Strain-Gauge Balances, 10-13 May 2010, Williamsburg, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 122711.03.09.07.02

Report No.(s): NF1676L-10694; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019163

A new high-capacity semi-span force and moment balance has recently been developed for use at the National Transonic Facility at the NASA Langley Research Center. This new semi-span balance provides the NTF a new measurement capability that will support testing of semi-span test models at transonic high-lift testing regimes. Future testing utilizing this new balance capability will include active circulation control and propulsion simulation testing of semi-span transonic wing models. The NTF has recently implemented a new highpressure air delivery station that will provide both high and low mass flow pressure lines that are routed out to the semi-span models via a set high/low pressure bellows that are indirectly linked to the metric end of the NTF-117S balance. A new check-load stand is currently being developed to provide the NTF with an in-house capability that will allow for performing check-loads on the NTF-117S balance in order to determine the pressure tare affects on the overall performance of the balance. An experimental design is being developed that will allow for experimentally assessing the static pressure tare affects on the balance performance.

Author

Balance; Experiment Design; Static Pressure; Active Control; Force Distribution; High Pressure; Loads (Forces); Mass Flow

02
AERODYNAMICS

Includes aerodynamics of flight vehicles, test bodies, airframe components and combinations, wings, and control surfaces. Also includes aerodynamics of rotors, stators, fans, and other elements of turbomachinery. For related information see also 34 Fluid Mechanics and Thermodynamics.

20100018494 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Aircraft Safety Study: Introduction of Glass Cockpit Avionics into Light Aircraft

March 09, 2010; 92 pp.; In English

Report No.(s): PB2010-917001; NTSB/SS-10/01; No Copyright; Avail.: CASI: A05, Hardcopy

In a span of only a few years, the cockpits of new light aircraft have undergone a transition from conventional analog flight instruments to digital-based electronic displays commonly referred to as glass cockpits. These new displays integrate aircraft control, autopilot, communication, navigation, and aircraft system monitoring functions, applying technology previously available only in transport-category aircraft. The enhanced function and information capabilities of glass cockpits represent a significant change and potential improvement in the way general aviation pilots monitor information needed to control their aircraft. The National Transportation Safety Board (NTSB) initiated this study to determine if the transition to glass cockpits in light aircraft has improved the safety record of those aircraft.

NTIS

Avionics; Cockpits; Glass; Light Aircraft; Safety; Safety Management; Transportation

20100018557 NASA Glenn Research Center, Cleveland, OH, USA

Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics

LaGraff, John E.; Povinelli, Louis A.; Gostelow, J. Paul; Glauser, Mark; February 2010; In English; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics, 23-26 Aug. 2009, Blue Mountain Lake, NY, USA; See also 20100018558 - 20100018586; CD-ROM contains zip files with PDFs, Word Docs, movies, animation

Contract(s)/Grant(s): NNX09AK41G; AFOSR-FA 9550-09-0631; N00014-09-1-0692; WBS 984754.02.07.03.11.03

Report No.(s): NASA/CP-2010-216112; E-17196; Copyright; Avail.: CASI: C01, CD-ROM

Topics covered include: Flow Physics and control for Internal and External Aerodynamics (not in TOC...starts on pg13); Breaking CFD Bottlenecks in Gas-Turbine Flow-Path Design; Streamwise Vortices on the Convex Surfaces of Circular Cylinders and Turbomachinery Blading; DNS and Embedded DNS as Tools for Investigating Unsteady Heat Transfer Phenomena in Turbines; Cavitation, Flow Structure and Turbulence in the Tip Region of a Rotor Blade; Development and Application of Plasma Actuators for Active Control of High-Speed and High Reynolds Number Flows; Active Flow Control of Lifting Surface With Flap-Current Activities and Future Directions; Closed-Loop Control of Vortex Formation in Separated Flows; Global Instability on Laminar Separation Bubbles-Revisited; Very Large-Scale Motions in Smooth and Rough Wall Boundary Layers; Instability of a Supersonic Boundary-Layer With Localized Roughness; Active Control of Open Cavities; Amplitude Scaling of Active Separation Control; U.S. Air Force Research Laboratory's Need for Flow Physics and Control With Applications Involving Aero-Optics and Weapon Bay Cavities; Some Issues Related to Integrating Active Flow Control With Flight Control; Active Flow Control Strategies Using Surface Pressure Measurements; Reduction of Unsteady Forcing in a Vaned, Contra-Rotating Transonic Turbine Configuration; Active Flow Control Stator With Coanda Surface; Controlling Separation in Turbomachines; Flow Control on Low-Pressure Turbine Airfoils Using Vortex Generator Jets; Reduced Order Modeling Incompressible Flows; Study and Control of Flow Past Disk, and Circular and Rectangular Cylinders Aligned in the Flow; Periodic Forcing of a Turbulent Axisymmetric Wake; Control of Vortex Breakdown in Critical Swirl Regime Using Azimuthal Forcing; External and Turbomachinery Flow Control Working Group; Boundary Layers, Transitions and Separation; Efficiency Considerations in Low Pressure Turbines; Summary of Conference; and Final Plenary Session Transcript.

Author

Flow Distribution; Aerodynamic Characteristics; Active Control; Boundary Layers; Computational Fluid Dynamics; Flow Velocity; Vortex Generators; Turbulent Heat Transfer; Surface Roughness; Reynolds Number

20100018558 Cambridge Univ., Cambridge, UK

Controlling Separation in Turbomachines

Evans, Simon; Himmel, Christoph; Power, Bronwyn; Wakelam, Christian; Xu, Liping; Hynes, Tom; Hodson, Howard; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 435-472; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018558

Four examples of flow control: 1) Passive control of LP turbine blades (Laminar separation control). 2) Aspiration of a conventional axial compressor blade (Turbulent separation control). 3) Compressor blade designed for aspiration (Turbulent separation control). 4.Control of intakes in crosswinds (Turbulent separation control).

Author

Turbomachinery; Compressor Blades; Turbine Blades; Turbocompressors

20100018559 Clarkson Univ., Potsdam, NY, USA

Reduced Order Modeling Incompressible Flows

Helenbrook, B. T.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 495-507; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018559

The details: a) Need stable numerical methods; b) Round off error can be considerable; c) Not convinced modes are correct for incompressible flow. Nonetheless, can derive compact and accurate reduced-order models. Can be used to generate actuator models or full flow-field models

Author

Actuators; Flow Distribution; Numerical Analysis; Incompressible Flow

20100018560 Imperial Coll. of London, London, UK

Periodic Forcing of a Turbulent Axisymmetric Wake

Qubain, Ala; Morrison, Jonathan; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 531-556; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018560

Effects of variable-frequency forcing. Relation to linear theory. Effects of three-dimensional forcing. Relation between instability mechanisms. Future work includes open-loop control and feedback control.

Author

Feedback Control; Frequencies; Turbulent Wakes; Loops; Shear Layers

20100018561 NASA Glenn Research Center, Cleveland, OH, USA

Boundary Layers, Transitions and Separation

Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 589-600; In English; See also 20100018557; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018561

Effects of roughness in boundary layers have to be addressed. Until adverse pressure gradient effects are understood, roughness will not significantly drive design. Mechanisms responsible for separation not understood. Effects on Zero Pressure Gradient boundary layers (shear stress). Effects on separation in pressure gradient (prediction of separation). Effect on scalar transport (heat transfer) not understood. Model for skin friction needed in simulations - first grid point likely to be in buffer layer. Definition of roughness important for useful experiments. A lot of validation experiments will be needed. How to get to ks for roughness of engineering interest? - depends on wavelength height, etc. for engineering interest? Re-discovering the wheel should be avoided: existing knowledge (theoretical and experimental) should find its way into the engineering models. It is a task of the industry to filter out the existing information in the literature for results relevant to its application, being external or internal.

Author

Boundary Layers; Surface Roughness; Computational Grids; Heat Transfer; Scalars; Shear Stress; Skin Friction

20100018562 Leibniz Universitaet, Hannover, Germany

Active Flow Control Stator With Coanda Surface

Guendogdu; Vorreiter; Seume; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 417-434; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018562

Active Flow Control increases the permissible aerodynamic loading. Curved surface near the trailing edge ('Coanda surface'): a) increases turning -> higher pressure ratio. b) controls boundary layer separation -> increased surge margin. Objective: Reduce the number of vanes or compressor stages. Constraints: 1. In a real compressor, the vane must still function entirely without blowing. 2. Maintain the flow exit angle of the reference stator despite the resulting increase in stator loading.

Author

Active Control; Flow Distribution; Boundary Layer Separation; Trailing Edges; Vanes; Coanda Effect; Aerodynamic Loads

20100018563 Ohio State Univ., OH, USA

Development and Application of Plasma Actuators for Active Control of High-Speed and High Reynolds Number Flows

Sammy, Mo; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 135-150; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018563

Active flow control is often used to manipulate flow instabilities to achieve a desired goal (e.g. prevent separation, enhance mixing, reduce noise, etc.). Instability frequencies normally scale with flow velocity scale and inversely with flow length scale (U/l). In a laboratory setting for such flow experiments, U is high, but l is low, resulting in high instability frequency. In addition, high momentum and high background noise & turbulence in the flow necessitate high amplitude

actuation. Developing a high amplitude and high frequency actuator is a major challenge. Ironically, these requirements ease up in application (but other issues arise).
Author
Active Control; Flow Distribution; Noise Reduction; Reynolds Number; Stability; Turbulence; Flow Velocity; Actuators

20100018564 Technische Univ., Berlin, Germany
Control of Vortex Breakdown in Critical Swirl Regime Using Azimuthal Forcing
Oberleithner, Kilian; Lueck, Martin; Paschereit, Christian Oliver; Wygnanski, Israel; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 557-583; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018564

We finally go back to the four swirl cases and see how the flow responds to either forcing m = -1 or m = -2. On the left we see the flow forced at m = -1 We see that the PVC locks onto the applied forcing also for lower swirl number causing this high TKE at the jet center. The amplification of this instability causes VB to occur at a lower swirl number. The opposite can be seen when forcing the flow at m=-2 which is basically growing in the outer shear layer causing VB to move downstream . There is no energy at the center of the vortex showing that the precessing has been damped. The mean flow is most altered at the swirl numbers were VB is unstable.
Author
Vortex Breakdown; Shear Layers; Vortices; Azimuth

20100018565 California Univ., Davis, CA, USA
Breaking CFD Bottlenecks in Gas-Turbine Flow-Path Design
Davis, Roger L.; Dannenhoffer, John F., III; Clark, John P.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 43-60; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018565

New ideas are forthcoming to break existing bottlenecks in using CFD during design. CAD-based automated grid generation. Multi-disciplinary use of embedded, overset grids to eliminate complex gridding problems. Use of time-averaged detached-eddy simulations as norm instead of 'steady' RANS to include effects of self-excited unsteadiness. Combined GPU/Core parallel computing to provide over an order of magnitude increase in performance/price ratio. Gas-turbine applications are shown here but these ideas can be used for other Air Force, Navy, and NASA applications.
Author
Computational Fluid Dynamics; Computer Aided Design; Grid Generation (Mathematics)

20100018566 Leicester Univ., UK
Streamwise Vortices on the Convex Surfaces of Circular Cylinders and Turbomachinery Blading
Gostelow, Paul; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 61-92; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018566

In assessing the results please recall that the Mach number regimes and model geometries differ considerably. Selection of the radius of curvature at the 10% chord location is consistent but arbitrary, although it does seem representative for most blades and gives a good fit for the results. Measured spanwise wavelengths of the periodic vortex arrays on blading are predicted well by the Kestin and Wood theory. If this behavior is at all common it could have implications for turbine aerodynamic and blade cooling design. The outcome is to establish that organized streamwise vorticity may occur more frequently on convex surfaces, such as turbine blade suction surfaces, than hitherto appreciated. Investigations and predictions of flow behavior should be extended to encompass that possibility.
Author
Circular Cylinders; Turbomachinery; Vorticity; Position (Location); Mach Number; Vortices; Turbine Blades; Aerodynamics

20100018567 Stanford Univ., CA, USA

Instability of a Supersonic Boundary-Layer with Localized Roughness

Marxen, Olaf; Iaccarino, Gianluca; Shaqfeh, Eric S. G.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 273-287; In English; See also 20100018557; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNX07AC29A; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018567

A localized 3-D roughness causes boundary-layer separation and (weak) shocks. Most importantly, streamwise vortices occur which induce streamwise (low U, high T) streaks. Immersed boundary method (volume force) suitable to represent roughness element in DNS. Favorable comparison between bi-global stability theory and DNS for a 'y-mode' Outlook: Understand the flow physics (investigate 'z-modes' in DNS through sinuous spanwise forcing, study origin of the beat in DNS).

Author

Boundary Layer Separation; Surface Roughness; Direct Numerical Simulation; Fluid Dynamics; Vortices

20100018568 Florida Univ., Gainesville, FL, USA

Active Control of Open Cavities

UKeiley, Lawrence; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 289-303; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018568

Open loop edge blowing was demonstrated as an effective method for reducing the broad band and tonal components of the fluctuating surface pressure in open cavities. Closed loop has been successfully applied to low Mach number open cavities. Need to push actuators that are viable for closed loop control in bandwidth and output. Need a better understanding of the effects of control on the flow through detailed measurements so better actuation strategies can be developed.

Author

Active Control; Mach Number; Actuators; Blowing; Bandwidth; Feedback Control; Broadband

20100018569 Clarkson Univ., Potsdam, NY, USA

Active Flow Control of Lifting Surface With Flap-Current Activities and Future Directions

Ahmadi, G.; Marzocca, P.; Jha, R.; Alstorm, B.; Obied, S.; Kabir, P.; Shahrabi, A.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 151-180; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018569

The main objective is to develop effective control strategies for separation control of an airfoil with a single hinge flap. The specific objectives are: Develop an active control architecture for flow control around an airfoil with flap. Design, fabricate, a wind tunnel test of a high lift wing (with flap) with integrated actuators and sensors. Design, development and fabrication of synthetic jet actuators. Develop appropriate control strategy for application to the airfoil. Wind tunnel testing of the high lift wing at various angles of attack and flap positions with closed loop control.

Author

Airfoils; Actuators; Wind Tunnel Tests; Control Surfaces; Feedback Control; Flow Distribution; Angle of Attack; Flapping

20100018570 Naval Academy, Annapolis, MD, USA

Flow Control on Low-Pressure Turbine Airfoils Using Vortex Generator Jets

Volino, Ralph J.; Ibrahim, Mounir B.; Kartuzova, Olga; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 473-494; In English; See also 20100018557; CD-ROM contains full presentation including animation; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018570

Motivation - Higher loading on Low-Pressure Turbine (LPT) airfoils: Reduce airfoil count, weight, cost. Increase efficiency, and Limited by suction side separation. Growing understanding of transition, separation, wake effects: Improved

models. Take advantage of wakes. Higher lift airfoils in use. Further loading increases may require flow control: Passive: trips, dimples, etc. Active: plasma actuators, vortex generator jets (VGJs). Can increased loading offset higher losses on high lift airfoils. Objectives: Advance knowledge of boundary layer separation and transition under LPT conditions. Demonstrate, improve understanding of separation control with pulsed VGJs. Produce detailed experimental data base. Test and develop computational models.
Author
Actuators; Boundary Layer Separation; Vortex Generators; Plasma Generators; Weight Reduction

20100018571 NASA Glenn Research Center, Cleveland, OH, USA
Efficiency Considerations in Low Pressure Turbines
Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 601-604; In English; See also 20100018557; Copyright; Avail.: CASI: A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018571

Issues & Topics Discussed: a) Aviation Week reported shortfall In LPT efficiency due to the application of 'high lift airfoils'. b) Progress in the design technologies in LPTs during the last 20 years: 1) Application of RANS based CFD codes. 2) Integration of recent experimental data and modeling of LPT airfoil specific flows into design methods. c) Opportunities to further enhance LPT efficiency for commercial aviation and military transport application and to impact emissions, noise, weight & cost.
Author
Computational Fluid Dynamics; Turbines; Low Pressure; Commercial Aircraft; Airfoils

20100018572 Air Force Research Lab., USA
U.S. Air Force Research Laboratory's Need for Flow Physics and Control With Applications Involving Aero-Optics and Weapon Bay Cavities
Schmit, Ryan; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 349-361; In English; See also 20100018557; CD-ROM contains full presentation including animation; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018572

To develop New Flow Control Techniques: a) Knowledge of the Flow Physics with and without control. b) How does Flow Control Effect Flow Physics (What Works to Optimize the Design?). c) Energy or Work Efficiency of the Control Technique (Cost - Risk - Benefit Analysis). d) Supportability, e.g. (size of equipment, computational power, power supply) (Allows Designer to include Flow Control in Plans).
Author
Fluid Dynamics; Flow Distribution; Military Technology; Research and Development; Cost Effectiveness; Cost Analysis; Risk

20100018573 Syracuse Univ., NY, USA
Study and Control of Flow Past Disk, and Circular and Rectangular Cylinders Aligned in the Flow
Higuchi, Hiroshi; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 509-529; In English; See also 20100018557; CD-ROM contains full presentation including movies; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018573

Methodology similar to that used for our closed-loop control of Separation over NACA 0012 Airfoil (Pinier et al, AIAA Journal 2007) Synthetic Jet Actuators, Miniature Pressure Transducers Split POD with and without Actuations Flow state estimation from Pressure signature
Author
Feedback Control; Pressure Sensors; Circular Cylinders; Miniaturization; Actuators; Airfoils

20100018574 California Inst. of Tech., Pasadena, CA, USA

Closed-Loop Control of Vortex Formation in Separated Flows

Colonius, Tim; Joe, Won Tae; MacMynowski, Doug; Rowley, Clancy; Taira, Sam; Ahuja, Sunil; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 181-204; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018574

In order to phase lock the flow at the desired shedding cycle, particularly at Phi,best, We designed a feedback compensator. (Even though the open-loop forcing at Wf below Wn can lead to phase-locked limit cycles with a high average lift,) This feedback controller resulted in the phase-locked limit cycles that the open-loop control could not achieve for alpha=30 and 40 Particularly for alpha=40, the feedback was able to stabilize the limit cycle that was not stable with any of the open-loop periodic forcing. This results in stable phase-locked limit cycles for a larger range of forcing frequencies than the open-loop control. Also, it was shown that the feedback achieved the high-lift unsteady flow states that open-loop control could not sustain even after the states have been achieved for a long period of time.

Author

Loops; Phase Locked Systems; Feedback Control; Unsteady Flow; Separated Flow; Controllers; Vortices

20100018575 Tel-Aviv Univ., Israel

Amplitude Scaling of Active Separation Control

Stalnov, Oksana; Seifert, Avraham; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 305-347; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018575

Three existing and two new excitation magnitude scaling options for active separation control at Reynolds numbers below one Million. The physical background for the scaling options was discussed and their relevance was evaluated using two different sets of experimental data. For F+ approx. 1, 2D excitation: a) The traditional VR and C(mu) - do not scale the data. b) Only the Re*C(mu) is valid. This conclusion is also limited for positive lift increment.. For F+ > 10, 3D excitation, the Re corrected C(mu), the St corrected velocity ratio and the vorticity flux coefficient, all scale the amplitudes equally well. Therefore, the Reynolds weighted C(mu) is the preferred choice, relevant to both excitation modes. Incidence also considered, using Ue from local Cp.

Author

Active Control; Reynolds Number; Excitation

20100018576 Universidad Politecnica de Madrid, Madrid, Spain

Global Instability on Laminar Separation Bubbles-Revisited

Theofilis, Vassilis; Rodriquez, Daniel; Smith, Douglas; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 205-257; In English; See also 20100018557; Original contains color and black and white illustrations

Contract(s)/Grant(s): FA8655-06-1-3066; Copyright; Avail.: CASI: A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018576

In the last 3 years, global linear instability of LSB has been revisited, using state-of-the-art hardware and algorithms. Eigenspectra of LSB flows have been understood and classified in branches of known and newly-discovered eigenmodes. Major achievements: World-largest numerical solutions of global eigenvalue problems are routinely performed. Key aerodynamic phenomena have been explained via critical point theory, applied to our global mode results. Theoretical foundation for control of LSB flows has been laid. Global mode of LSB at the origin of observable phenomena. U-separation on semi-infinite plate. Stall cells on (stalled) airfoil. Receptivity/Sensitivity/AFC feasible (practical?) via: Adjoint EVP solution. Direct/adjoint coupling (the Crete connection). Minor effect of compressibility on global instability in the subsonic compressible regime. Global instability analysis of LSB in realistic supersonic flows apparently quite some way down the horizon.

Author

Aerodynamic Characteristics; Eigenvalues; Numerical Analysis; Supersonic Flow; Airfoils; Compressibility; Critical Point

20100018577 California Inst. of Tech., Pasadena, CA, USA

Very Large-Scale Motions in Smooth and Rough Wall Boundary Layers

McKeon, Beverley J.; Guala, Michele; LeHew, Jeff; Jacobi, Ian; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 259-271; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018577

Structural skeleton of high Reynolds number flow gives insight into smooth and rough walls. (modeling implications not yet clear) Dynamic roughness as a model of 'designer' roughness: a) Impose length scale(s) and dominant frequency. b) Irregular roughness well-represented by first 'few' POD modes (Christensen, 2009). Experiments and simple model demonstrate: a) Harmonics associated with forcing (and w) important. b) Change to the mean profile (skin friction).

Author

High Reynolds Number; Musculoskeletal System; Surface Roughness; Boundary Layers; Frequencies; Skin Friction

20100018578 NASA Glenn Research Center, Cleveland, OH, USA

External and Turbomachinery Flow Control Working Group

Ahmadi, G.; Alstrom, B.; Colonius, T.; Dannenhoffer, J.; Glauser, M.; Helenbrook, B.; Higuchi, H.; Hodson, H.; Jha, R.; Kabiri, P.; LaGraff, J.; Low,K.; McKeon, B.; Morrison, J.; Obcid, S.; Orbaker, A.; Samimy, M.; Schmit, R.; Seifert, A.; Seume, J.; Shahabi, A.; Shea, P.; Ukeiley, L.; Wallace, R.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 585-587; In English; See also 20100018557; Copyright; Avail.: CASI: A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018578

Broad Flow Control Issues: a) Understanding flow physics. b) Specific control objective(s). c) Actuation. d) Sensors. e) Integrated active flow control system. f) Development of design tools (CFD, reduced order models, controller design, understanding and utilizing instabilities and other mechanisms, e.g., streamwise vorticity).

Author

Active Control; Flow Distribution; Systems Integration; Turbomachinery; Fluid Dynamics; Computational Fluid Dynamics

20100018579 Arizona Univ., Tucson, AZ, USA

Flow Physics and Control for Internal and External Aerodynamics

Wygnanski, I.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 1-36; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018579

Exploiting instabilities rather than forcing the flow is advantageous. Simple 2D concepts may not always work. Nonlinear effects may result in first order effect. Interaction between spanwise and streamwise vortices may have a paramount effect on the mean flow, but this interaction may not always be beneficial.

Author

Aerodynamics; Fluid Dynamics; Stability; Vortices

20100018580 Imperial Coll. of London, London, UK

Summary of Conference

Morrison, Jonathan; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 605-621; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018580

Environmental issues are a key driver. The need for better mechanisms to enable discipline hopping/crossover (materials (MEMS), control, fluids). Better sensors and actuators and better communication for these to be developed. Better understanding of the needs of the turbomachinery industry, especially in identifying where flow control can be beneficial (e.g., variable intake geometry). Challenge for flow control to be fail-safe, or to be developed for non-critical control gains (e.g., noise). more detailed information on stage through-flow behaviour (with/without control) increased use of laser interrogation (PIV, PTV, MTV).

Author

Microelectromechanical Systems; Turbomachinery; Actuators; Fail-Safe Systems; Particle Image Velocimetry

20100018581 Johns Hopkins Univ., MD, USA

Cavitation, Flow Structure and Turbulence in the Tip Region of a Rotor Blade

Wu, H.; Miorini, R.; Soranna, F.; Katz, J.; Michael, T.; Jessup, S.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 117-133; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018581

Objectives: Measure the flow structure and turbulence within a Naval, axial waterjet pump. Create a database for benchmarking and validation of parallel computational efforts. Address flow and turbulence modeling issues that are unique to this complex environment. Measure and model flow phenomena affecting cavitation within the pump and its effect on pump performance. This presentation focuses on cavitation phenomena and associated flow structure in the tip region of a rotor blade.

Author

Cavitation Flow; Hydraulic Jets; Turbulence Models

20100018582 Air Force Research Lab., USA

Reduction of Unsteady Forcing in a Vaned, Contra-Rotating Transonic Turbine Configuration

Clark, John; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 399-416; In English; See also 20100018557; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018582

HPT blade unsteadiness in the presence of a downstream vane consistent with contra-rotation is characterized by strong interaction at the first harmonic of downstream vane passing. E An existing stage-and-one-half transonic turbine rig design was used as a baseline to investigate means of reducing such a blade-vane interaction. E Methods assessed included: Aerodynamic shaping of HPT blades 3D stacking of the downstream vane Steady pressure-side blowing E Of the methods assessed, a combination of vane bowing and steady pressure-side blowing produced the most favorable result. E Transonic turbine experiments are planned to assess predictive accuracy for the baseline turbine and any design improvements.

Author

Turbine Blades; Supersonic Turbines; Rotation; Vanes; Blowing

20100018583 Karlsruhe Univ., Germany

DNS and Embedded DNS as Tools for Investigating Unsteady Heat Transfer Phenomena in Turbines

vonTerzi, Dominic; Bauer, H.-J.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 93-116; In English; See also 20100018557; CD-ROM contains full presentation including animation; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018583

DNS is a powerful tool with high potential for investigating unsteady heat transfer and fluid flow phenomena, in particular for cases involving transition to turbulence and/or large coherent structures. - DNS of idealized configurations related to turbomachinery components is already possible. - For more realistic configurations and the inclusion of more effects, reduction of computational cost is key issue (e.g., hybrid methods). - Approach pursued here: Embedded DNS (segregated coupling of DNS with LES and/or RANS). - Embedded DNS is an enabling technology for many studies. - Pre-transitional heat transfer and trailing-edge cutback film-cooling are good candidates for (embedded) DNS studies.

Author

Direct Numerical Simulation; Heat Transfer; Turbulent Heat Transfer; Fluid Flow; Trailing Edges; Turbomachinery

20100018584 Illinois Inst. of Tech., Chicago, IL, USA

Some Issues Related to Integrating Active Flow Control With Flight Control

Williams, David; Colonius, Tim; Tadmor, Gilead; Rowley, Clancy; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 363-374; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ONLINE: http://hdl.handle.net/2060/20100018584

Time varying control of CL is necessary for integrating AFC and Flight Control (Biasing allows for +/- changes in lift)

Time delays associated with actuation are long (APPROX.5.8 c/U) and must be included in controllers. Convolution of input signal with single pulse kernel gives reasonable prediction of lift response.
Author
Active Control; Flight Control; Flow Distribution; Time Lag; Automatic Frequency Control

20100018585 Florida Center for Advanced Aero-Propulsion (FCAAP), Tallahassee, FL, USA
Active Flow Control Strategies Using Surface Pressure Measurements
Kumar, Vikas; Alvi, Farrukh S.; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 375-398; In English; See also 20100018557; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018585

Evaluate the efficacy of Microjets Can we eliminate/minimize flow separation? Is the flow unsteadiness reduced? Guidelines for an active control Search for an appropriate sensor. Examine for means to develop a flow model for identifying the state of flow over the surface Guidelines toward future development of a Simple and Robust control methodology
Author
Active Control; Pressure Measurement; Flow Distribution; Separated Flow

20100018586 Leicester Univ., UK
Final Plenary Session Transcript
Gostelow, Paul; Minnowbrook VI: 2009 Workshop on Flow Physics and Control for Internal and External Aerodynamics; February 2010, pp. 623-638; In English; See also 20100018557; Copyright; Avail.: CASI: A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document
ONLINE: http://hdl.handle.net/2060/20100018586

Let s start with the report - as you know - when we are talking about flow control it is a multi-disciplinary type of work. So it involves many people and disciplines. This group first discussed the important issues associated with flow control. As you start doing flow control what are the issues to which you really have to start paying attention? That is the first part I am going to present. Then in the second part I will present some challenges - problems that we should really be looking at. So as far as the issues - if you want to control a flow, you really need to understand the flow physics, because anything that you do comes from the flow physics. The design of the controllers, your decisions on the actuators, sensors, reduced order modeling and all of that, would be helped if you understand flow physics. And you have to have a specific objective - what exactly are you controlling? Are you trying to reduce drag, eliminate separation, reduce noise, enhance mixing? So you have to have very specific control objectives. From all the talks we have seen here actuation is extremely important and it is very problem specific. It depends on what problem you are dealing with so you have to design and build actuators for that specific problem. Sensors obviously are very important, especially when you are dealing with feedback control. Consensus was that when you dealing with flow control, you must take an integrated approach; from the beginning you have to take into account every aspect of it and even maybe to modify your experiment, your geometry, to go along with the actuation, sensors and control models. Development of tools is very important in this multi-disciplinary problem. The tools include CFD, reduced order modeling, controller design, understanding and utilizing the instabilities of the flow, etc. So, in order to have success in flow control, we really need to develop these tools.
Author
Computational Fluid Dynamics; Control Systems Design; Drag Reduction; Noise Reduction; Actuators; Fluid Dynamics

20100019015 Naval Postgraduate School, Monterey, CA USA
Experimental Investigation of an Oscillating Flow Generator
Semler, Cogan S; Mar 2010; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project was to construct and test a device that can transform fluid flow into the continuous oscillatory linear motion of a hydro/airfoil. This device may be used to generate power from a renewable energy source such as tidal flow or wind power. The device was constructed in the NPS machine shop. It consisted of a flat plate that is mounted on two rail guides such that it can execute a linear back-and-forth motion. The blade oscillation is flow induced due to the lift and the moment generated on the flat plate in such a way that the plate reverses direction at the stroke endpoints without active control. Tests in two water channels and one towing tank showed that flow-induced blade oscillation could be achieved for certain

combinations of flow speed, blade size and pitch axis location. It is concluded that additional testing is warranted to further develop and gain understanding of this technology and its possible application to renewable power generations.
DTIC
Launch Vehicles; Oscillating Flow; Oscillations; Tides; Unsteady Flow; Wings

20100019178 Naval Postgraduate School, Monterey, CA USA
Computation of the Safety Fans for Multistage Aerodelivery Systems
Corley, Melissa S; Yakimenko, Oleg A; May 7, 2009; 14 pp.; In English
Report No.(s): AD-A517945; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517945

This paper deals with the development of a mathematical foundation and practical algorithms to compute the safety fans to be used in conjunction with aerodynamic deceleration payload delivery systems tests. The paper provides formulas to compute a descent/gliding trajectory for a multiple-stage system and then considers several cases of major failures, It also introduces the concept of ballistic winds, simplifying calculation of the safety fans so that the computer is no longer needed, and shows how to carefully calculate these ballistic winds based on the best known winds aloft. Finally, the paper introduces the graphical user interface developed and tested by the authors that is supposed to provide test planning officers with a unique variety of trade-off options as well as to effectively represent all safety-related information both to the ground personnel and to the crew performing a payload delivery from a transport aircraft or helicopters.
DTIC
Air Cargo; Delivery; Safety

20100019426 William J. Hughes Technical Center, Atlantic City, NJ, USA; National Aerospace Lab., Amsterdam, Netherlands; Cherokee CRC, LLC, Tulsa, OK, USA
Estimation of Landing Stopping Distances from Flight Data
va Es, G. W. H.; van der Geest, P. J.; Cheng, A.; Hackler, L.; Feb. 2010; 26 pp.; In English
Report No.(s): PB2010-107544; No Copyright; Avail.: National Technical Information Service (NTIS)

The need for improved capacity at airports to accommodate the rapid growth of air traffic has led to the investigation of operational landing performance as a safe and feasible means to increase the traffic flow. While the capacity issue becomes important, it is imperative that the increase in capacity does not let safety decline. A key task is to investigate the airplane landing performance to provide operations safety guidelines for reducing the risks of incidents and accidents associated with new technologies and procedures. For this, a clear knowledge of the day-to-day landing operations is required. The objective of the present study was to derive and analyze methods for calculating the full-stop landing distance from flight operational data. In total, eight methods have been defined to calculate the ground distance from actual landing data. All these variants have been implemented in the processing software. After reprocessing all available cases, the statistical properties and possible correlations of each variant were investigated and presented. Based on these results, it was concluded that ground stopping distances obtained with the maximum instantaneous deceleration approach may be considered as the most useful or realistic candidate to serve as an indicator for the actual airplane landing performance.
NTIS
Air Traffic; Aircraft Landing; Aircraft Performance; Airports; Distance; Stopping

20100019443 NASA Glenn Research Center, Cleveland, OH, USA
Wind Tunnel Model Design for the Study of Plume Effects on Sonic Boom for Isolated Exhaust Nozzles
Castner, Raynold S.; April 2010; 17 pp.; In English; 45th Joint Propulsion Conference and Exhibit, 2-5 Aug. 2009, Denver, CO′, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.13.05
Report No.(s): NASA/TM-2010-216259; AIAA Paper 2009-5369; E-17047-1; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019443

A low cost test capability was developed at the NASA Glenn Research Center 1- by 1-Foot Supersonic Wind Tunnel (SWT), with a goal to reduce the disturbance caused by supersonic aircraft flight over populated areas. This work focused on the shock wave structure caused by the exhaust nozzle plume. Analysis and design was performed on a new rig to test exhaust nozzle plume effects on sonic boom signature. Test capability included a baseline nozzle test article and a wind tunnel model consisting of a strut, a nosecone and an upper plenum. Analysis was performed on the external and internal aerodynamic

configuration, including the shock reflections from the wind tunnel walls caused by the presence of the model nosecone. This wind tunnel model was designed to operate from Mach 1.4 to Mach 3.0 with nozzle pressure ratios from 6 to 12 and altitudes from 30,000 ft (4.36 psia) to 50,000 ft (1.68 psia). The model design was based on a 1 in. outer diameter, was 9 in. in overall length, and was mounted in the wind tunnel on a 3/8 in. wide support strut. For test conditions at 50,000 ft the strut was built to supply 90 psia of pressure, and to achieve 20 psia at the nozzle inlet with a maximum nozzle pressure of 52 psia. Instrumentation was developed to measure nozzle pressure ratio, and an external static pressure probe was designed to survey near field static pressure profiles at one nozzle diameter above the rig centerline. Model layout placed test nozzles between two transparent sidewalls in the 1 1 SWT for Schlieren photography and comparison to CFD analysis.
Author
Wind Tunnel Tests; Supersonic Aircraft; Aerodynamic Configurations; Low Cost; Supersonic Wind Tunnels; Wind Tunnel Models; Sonic Booms; Static Pressure; Pressure Sensors; Exhaust Nozzles

20100019920 Duke Univ., Durham, NC USA
Nonlinear Aeroelastic Study for Folding Wing Structures
Dowell, Earl H; Tang, Deman; Attar, Peter; Mar 29, 2010; 135 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-C-0105
Report No.(s): AD-A519459; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A folding wing structure consisting of three components: fuselage, inboard wing and outboard wing, is modeled computationally using a geometrically nonlinear structural dynamics theory based upon von Karman strains and at three-dimensional nonlinear potential flow aerodynamic model. The structural dynamic equations of motion are discretized in space using a discrete Ritz basis derived from finite element analysis and component synthesis and the aerodynamic model is discretized using a vortex lattice. Results from the computational model are compared to those from experiments designed and tested in the Duke University wind tunnel for three folding wing configurations. It is found that limit cycle oscillation magnitude and frequency results from theory compare well with those measured in the experiment. Also it appears that structural nonlinearities are stronger than aerodynamic nonlinearities for the cases studied.
DTIC
Aeroelasticity; Cycles; Flutter; Folding; Folding Structures; Mathematical Models; Nonlinearity; Oscillations; Wind Tunnel Tests; Wings

20100019928 Duke Univ., Durham, NC USA
Nonlinear High Fidelity Aeroelastic Analysis for Novel Configurations
Attar, Peter J; Tang, Deman; Dowell, Earl H; Mar 29, 2010; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-09-1-0066
Report No.(s): AD-A519475; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A folding wing structure consisting of three components: fuselage, inboard wing and outboard wing, is modeled computationally using a geometrically nonlinear structural dynamics theory based upon von Karman strains and at three-dimensional nonlinear potential flow aerodynamic model. The structural dynamic equations of motion are discretized in space using a discrete Ritz basis derived from finite element analysis and component synthesis and the aerodynamic model is discretized using a vortex lattice. Results from the computational model are compared to those from experiments designed and tested in the Duke University wind tunnel for three folding wing configurations. It is found that limit cycle oscillation magnitude and frequency results from theory compare well with those measured in the experiment. Also it appears that structural nonlinearities are stronger than aerodynamic nonlinearities for the cases studied.
DTIC
Aerodynamics; Aeroelasticity; Nonlinear Systems; Nonlinearity

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; airport ground operations; flight safety and hazards; and aircraft accidents. Systems and hardware specific to ground operations of aircraft and to airport construction are covered in 09 Research and Support Facilities (Air). Air traffic control is covered in 04 Aircraft Communications and Navigation. For related information see also 16 Space Transportation and Safety and 85 Technology Utilization and Surface Transportation.

20100018539 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
Can Regulatory Bodies Expect Efficient Help from Formal Methods?
Lopez Ruiz, Eduardo R.; Lemoine, Michel; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 87-96; In English; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018539

In the context of EDEMOI - a French national project that proposed the use of semiformal and formal methods to infer the consistency and robustness of aeronautical regulations through the analysis of faithfully representative models- a methodology had been suggested (and applied) to different (safety and security-related) aeronautical regulations. This paper summarizes the preliminary results of this experience by stating which were the methodology s expected benefits, from a scientific point of view, and which are its useful benefits, from a regulatory body s point of view.
Author
Regulations; Flight Safety; Airport Security; Aircraft Safety; Aerospace Safety; Airports; Air Transportation

20100018658 Marine Corps Development and Education Command, Quantico, VA USA
CAS - A Turboprop Solution for the COIN Fight
Scott, Roberto C; Jan 2009; 22 pp.; In English
Report No.(s): AD-A517800; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517800

The Counter Insurgency (COIN) fight and asymmetric warfare in general, have become the new norm in modem warfare. As the U.S. military adapts to this ever-evolving fight, a shortfall has developed in Close Air Support (CAS) delivery. Modem U.S. fighters bring a terrific punch to the battlefield, but their limited on-station time and high attack velocities make them a poor fit for complex CAS delivery in the COIN fight. Attack helicopters are formidable platforms, but their slow speeds make for long transit times to and from the fight. Fixed wing and rotary wing attack aircraft are very expensive machines to fly and maintain. Today's Forward Air Controller (FAC) is often under fire, on the move, or cannot see the target. Our Information Surveillance and Reconnaissance aircraft are over-worked and in high demand: A possible solution is an off-the-shelf turboprop aircraft. There are several models available immediately that can solve many of these problems. Modem turboprop aircraft are fast; most of the models presented here are 300+knot aircraft. They can deliver ordnance at survivable speeds that still allow for solid target acquisition. These aircraft are very affordable. The initial purchase prices are fractions of what a modern jet costs. Turboprops are much cheaper to operate than rotor wing or fixed wing aircraft. They are survivable. Many of these aircraft are built with the latest Aviation Survivability Equipment installed, or at least hardwired for the upgrade. Modern turboprops have incredible endurance; some of the models here can loiter for 5+ hours of on-station time. This allows the pilot to develop a high degree of situational awareness and to direct the airborne fight with precision. Most of the turboprops presented here are hardwired for off-the-shelf sensors, such as the third generation Brite Star from FLIR Systems.
DTIC
Aircraft; Support Systems; Turboprop Engines

20100018708 Naval Postgraduate School, Monterey, CA USA
Optimal Control for Terminal Guidance of Autonomous Parafoils
Slegers, Nathan J; Yakimenko, Oleg A; May 7, 2009; 22 pp.; In English
Report No.(s): AD-A517940; AIAA-2009-2958; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517940

This paper deals with the development of guidance, navigation and control algorithms for a prototype of a miniature aerial delivery system capable of high-precision maneuvering and high touchdown accuracy. High accuracy enables use in precision troop resupply, sensor placement, urban warfare reconnaissance, and other similar operations. Specifically, this paper addresses the terminal phase, where uncertainties in winds cause most of the problems. The paper develops a six degree-of-freedom model to adequately address dynamics and kinematics of the prototype delivery system and then reduces

it to a two degrees-of-freedom model to develop a model predictive control algorithm for reference trajectory tracking during all stages. Reference trajectories are developed in the inertial coordinate frame associated with the target. The reference trajectory during terminal guidance, just prior to impact, is especially important to the final accuracy of the system. This paper explores an approach for generating reference trajectories based on the inverse dynamics in the virtual domain. The method results in efficient solution of a two-point boundary-value problem onboard the aerial delivery system allowing the trajectory to be generated at a high rate, mitigating effects of the unknown winds. This paper provides derivation of the guidance and control algorithms and present analysis through simulation.
DTIC
Air Cargo; Autonomy; Delivery; Optimal Control; Parafoils; Terminal Guidance

20100018714 Naval Postgraduate School, Monterey, CA USA
Mobile System for Precise Aero Delivery with Global Reach Network Capability
Yakimenko, Oleg A; Slegers, Nathan J; Bourakov, Eugene A; Hewgley, Charles W; Bordetsky, Alex B; Jensen, Red P; Robinson, Andrew B; Malone, Josh R; Heidt, Phil E; Aug 30, 2009; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517956; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517956

This paper discusses the current status of the development of the mobile aerial delivery system to be further employed in a variety of different applications. High accuracy of the developed system enables its use in precision troop resupply, precise sensors placement, urban warfare reconnaissance and other similar operations. This paper overviews the overall system architecture and components of the developed aero delivery system itself and then proceeds with describing the current status of integrating it with an advanced deployment platform, unmanned aerial system, to achieve mobility and autonomy of operations. The paper also discusses some other systems in development pursuing similar goals and reviews some novel applications that become possible with the developed aerial delivery system.
DTIC
Air Cargo; Delivery; Parafoils

20100018715 Naval Postgraduate School, Monterey, CA USA
Using Direct Methods for Terminal Guidance of Autonomous Aerial Delivery Systems
Yakimenko, Oleg A; Slegers, Nathan J; Aug 26, 2009; 7 pp.; In English
Report No.(s): AD-A517960; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517960

This paper discusses the usage of direct methods of calculus of variations for real-time optimization of a final turn-into-the-wind maneuver for autonomous guided parafoil-based delivery systems. It reviews several approaches that are currently being pursued by different developers of such systems and discusses the necessity of usage and applicability of a direct method to optimize the final turn. The proposed approach seeks for an optimal solution within a certain class of parameterized inertial trajectories and further employs inverse dynamics to find the corresponding control. This approach has been successfully used in a variety of real-time applications already and proved to work well in a developed miniature aerial delivery system, Snowflake, as well. The paper presents the results of the most recent real drops and ends with a discussion of the developed algorithm as compared to another one, pursued by Draper Laboratory, where instead of parameterizing a reference trajectory the control itself is being parameterized. The paper ends with conclusions.
DTIC
Air Cargo; Autonomy; Delivery; Optimization; Parafoils; Terminal Guidance

20100018723 Air Univ., Maxwell AFB, AL USA
Responding to the Developing Aerospace Leaders Initiative: A Master Attack Plan for Reforming Undergraduate Professional Development
Drohan, Tom; Murray, Doug; Jan 2001; 11 pp.; In English
Report No.(s): AD-A517976; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517976

Developing 21st century aerospace leaders will begin in the traditional way, with precommissioning education and training. Effective education in the basics of aerospace power and military principles will be more crucial than ever. Colonels Drohan and Murray propose an integration of the commissioning sources, led by the Air Force Academy, to produce a

curriculum that more strongly emphasizes aerospace-power strategy while maintaining each source's unique character.
DTIC
Aerospace Systems; Armed Forces (United States); Education; Leadership; Military Personnel

20100018724 Air Univ., Maxwell AFB, AL USA
In Search of a Twenty-First-Century Air-Leadership Model: Fodder for Your Professional Reading
Mets, David R; Jan 2001; 13 pp.; In English
Report No.(s): AD-A517977; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517977

Where can future aerospace leaders find guidance and inspiration? One route is to reap the benefit of past experience through a vigorous professional reading program. In the latest installment of his popular ?fodder? series of articles, Dr. Mets provides the air warrior-scholar with a sampler of important books on aerospace leadership. The quest for a key to successful air leadership is as old as airpower itself. An Air Force Academy was first proposed in Congress in 1919, and 1931 Randolph Air Force Base (AFB) was known as The West Point of the Air. Yet, until fairly recently, professional air warriors have had slim pickings when they looked for case studies in airpower leadership. For a long time, we have had many biographies of soldiers and seamen, but common perceptions hold that airmen are not a contemplative lot and have little inclination toward literary efforts. Few of them have set pen to paper to tell either their own life stories or those of other flyers. Still fewer scholars and foundations have felt sufficiently competent to undertake such studies. But in the past two decades, that void has begun to be filled. This article first explores the nature of models. What are they? What are they good for? What are they not good for? It then turns to sources of biographical material on airmen and the nature of biography as a vehicle for exploring the subject of air leadership. It further examines the advantages of the biographical approach and its shortcomings. The article illustrates these matters with reviews of two forthcoming books about air leadership -- one on Maj Gen Mason M. Patrick and the other on Adm Joseph M. Reeves. It then suggests some possible benefits as well as the limitations of biographies and, in keeping with my fodder series of articles, closes with a 10-Book Sampler for Professional Reading.
DTIC
Armed Forces (United States); Leadership; Military Personnel; Reading

20100018797 Army War Coll., Carlisle Barracks, PA USA
Army Aviation's Role in USAFRICOM and USA Army Africa
Kubica, Scott; Feb 16, 2010; 35 pp.; In English
Report No.(s): AD-A518149; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518149

Arguably until 9/11, Africa was deemed insignificant by the USA in terms of strategic value. The events on 9/11, together with drought, famine, energy security, global trade, and violent extremist organizations, have changed the USA' strategic view of Africa. The missions and organization of two new entities, USA Africa Command (USAFRICOM) and the USA Army Africa (USARAF), are designed to integrate with the civil and military operations taking place on the African continent. So far, there has been little discussion as to what Army aviation assets should be used to support USAFRICOM and USARAF. The intent of this paper is to explore the ways in which U.S. Army Aviation can support USAFRICOM and USARAF and provide solutions to the unique challenges they face on the African continent. The paper illustrates the specific aircraft types that can be used to accomplish the wide array of missions required on the vast African continent. In addition, it emphasizes the necessity of the U.S. Army Aviation Center of Excellence (USAACE) to work with the Department of the Army in developing an aviation force structure that will meet the needs of USAFRICOM and USARAF.
DTIC
Africa; Security; Stability; United States

20100018894 Clark Univ., Worcester, MA USA
Transmission of Radio-Frequency Signals Through Plasma During Hypersonic Flight
Sternberg, Natalia; Feb 24, 2010; 35 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0415
Report No.(s): AD-A518365; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the proposed research project was to address the problem of communication black-out with a vehicle during a sustained hypersonic flight. Attempts to communicate through dense plasmas, which forms around an aircraft during hypersonic flight, fail when the transmitted wave frequency is below the plasma frequency. Under such conditions, the

transmitted propagating wave becomes evanescent inside the plasma layer and its amplitude is exponentially attenuated. It was demonstrated that without accounting for dissipation, anomalous plasma transparency to radio-frequencies can be achieved via amplification of evanescent waves using a diffraction grating, periodic plasma modulation, or a barrier. For dissipative plasma, adequate transmission can be achieved using a diffraction grating or periodic modulation. Furthermore, using a barrier, reflectionless transmission and absorption can be achieved in dissipative plasma.
DTIC
Hypersonic Flight; Plasmas (Physics); Radio Frequencies; Telecommunication

20100019002 Naval Postgraduate School, Monterey, CA USA
Aviation Proof of Concept: The Transition of Marine Corps Aviation Maintenance Computer Assets and Systems into the Navy Marine Corps Intranet
Hightower, Gerald R; Mar 2010; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518663; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Navy Marine Corps Intranet began planning to transition Marine Corps aviation computer assets to the NMCI network in 2004. Despite the preceding years of transferring other Navy and Marine Corps IT assets, NMCI offered no assurances that the transfer of Marine Corps aviation maintenance computers and systems would transition to NMCI without service interruption. Marine Corps aviation units use the Naval Tactical Combat Support System (NTCSS) every day in garrison and while deployed to document and track maintenance actions; it is the mandatory element necessary to enable Marine Corps aviation units to maintain aircraft operational readiness. The Marine Requirements Oversight Council concluded that a proof of concept would be conducted to ensure NMCI computers would meet the requirements for Marine Corps deploying units. Contract line item number 0004AC (CLIN 4AC) was selected as the most effective and affordable CLIN from the NMCI products. Marine aviation was chosen as the test element since IT connectivity in garrison and while deployed is crucial to maintain aircraft readiness. This thesis followed the Aviation Proof of Concept (APOC) from its requirements phase to final implementation. It started with developmental testing to identify issues in relation to transitioning the Marine Corps aviation NTCSS network into NMCI. The issues discovered during the development test were brought foreword for the APOC's Test Integration Working Group (TIWG) to analyzed and mitigate. The APOC's operational test used actual Marine aviation units to operate NMCI deployable computers in a real-world environment. The thesis concludes with the current APOC status and future research.
DTIC
Aircraft Maintenance; Computer Networks; Computers; Military Aviation; Navy; Proving

20100019177 Naval Postgraduate School, Monterey, CA USA; Army Yuma Proving Ground, Yuma, AZ, USA
Concept Refinement of a Payload Derived Position Acquisition System for Parachute Recovery Systems
Tiaden, Ryan D; Yakimenko, Oleg A; May 7, 2009; 9 pp.; In English; Aerodynamic Decelerator Systems Technology Conference and Seminar (20th), 4-7 May 2009, Seattle, WA, USA
Report No.(s): AD-A517946; AIAA Paper 2009-2948; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517946

The paper covers the continued development of a Payload Derived Position Acquisition System (PDPAS) to overcome current limitations posed on recovering the trajectory data for a generic parachute recovery system (PRS). The PDPAS is an instrumentation set and software algorithm that is to be installed onto PRS in order to estimate PRS state vector parameters in real-time for testing and operational use. The development of the PDPAD has progressed to a point where it is providing quality data and is ready for development into usable instrumentation package. The paper discusses the concept of the PDPAS, the first implementation of the PDPAS, changes made to the PDPAS due to continued development, and the steps needed for the PDPAS to be a validated instrumentation package.
DTIC
Parachutes; Payloads

20100019369 Air Force Research Lab., Mesa, AZ USA
Fiber Optic Helmet Mounted Display
Brunderman, John; Apr. 28, 1987; 16 pp.; In English; American Institute of Aeronautics and Astronautics Conference, 28-30 Apr. 1987, Hampton, VA, USA
Contract(s)/Grant(s): Proj-2743
Report No.(s): AD-A518209; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518209

The briefing covers the capabilities, current status and future plans of the Fiber Optic Helmet Mounted Display (FOHMD)

being developed under a joint US/Canada cost-sharing program. The technology is intended to fill a gap that exists in simulator visual displays. The technology is not classified and has been briefed a number of occasions throughout the simulation industry. This briefing was given previously to the joint US/Canada Working Group who supports this project. It contains a pictorial description of the design concept, a table of training requirements versus display performance, the current status of the development effort, recognized technical problems with improvements underway to eliminate them, and an anticipated schedule for demonstration. The briefing follows the viewgraphs and describes their intent in slightly more detail.
DTIC
Fiber Optics; Flight Simulation; Flight Simulators; Helmet Mounted Displays

20100019417 Naval Postgraduate School, Monterey, CA USA
The Uniform Price Quality Adjusted Discount Auction for Aviation Continuation Pay: Potential Benefits to the U.S. Marine Corps
White, Christopher S; Mar 2010; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This objective of this thesis is to explore the potential benefits realized by the Marine Corps if the current Aviation Continuation Pay (ACP) system is replaced with an auction mechanism that utilizes Quality Adjusted Discount (QUAD) methodology. The Uniform Price Quality Adjusted Discount Auction is designed to reduce the total cost of ACP while simultaneously increasing the overall quality of the aviators being retained. The goal of this study was to evaluate the existing ACP system and through experimentation, coupled with economical analyses, determine the feasibility of replacing the current system of assigning the aviator retention bonus with one that incorporates QUAD methodology. The QUAD auction mechanism caters to a wide range of individual reservation values resulting from various economic conditions. An ACP auction would reflect changing economic conditions, because aviators would reveal their true reservation values when bidding. Although an auction mechanism may not always result in a cost savings, it will ensure that the bonus amounts are set at the correct levels. If a QUAD auction were used in lieu of the current ACP system, Marine Corps manpower planners would have the flexibility to more cost effectively retain higher quality aviators while achieving Marine Corps aviator retention goals.
DTIC
Military Aviation; Aircraft Pilots; Manpower; Cost Reduction

20100019419 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Architectural Considerations for Single Operator Management of Multiple Unmanned Aerial Vehicles
Bugajski, Gabriel T.; June 2010; 89 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-ENY 08-257; Proj-NY 09-353
Report No.(s): AD-A518058; AFIT/GSE/ENV/10-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518058

Recently, small Unmanned Aircraft Systems (UAS) have become ubiquitous in military battlefield operations due to their intelligence collection capabilities. However, these unmanned systems consistently demonstrate limitations and shortfalls with respect to size, weight, range, line of sight and information management. The USA Air Force Unmanned Aircraft Systems Flight Plan 2009-2047 describes an action plan for improved UAS employment which calls out single operator, multi-vehicle mission configurations. This thesis analyzes the information architecture using future concepts of operations, such as biologically-inspired flocking mechanisms. The analysis and empirical results present insight into the engineering of single-operator multiple-vehicle architectures.
DTIC
Architecture (Computers); Data Processing; Pilotless Aircraft; Systems Engineering

20100019688 Naval Air Station, Oak Harbor, WA USA
Syncope as the First Sign of Complete Heart Block in a Military Aviator
Gould, Ryan K; Apr 2010; 3 pp.; In English
Report No.(s): AD-A518981; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518981

Syncope in an aviator may lead to abrupt loss or impairment of control of an aircraft and is thus a threat to safety of flight. Consequently, it is vital to conduct a thorough medical evaluation of any syncopal episode in a pilot or other flight crewmember. Case Presentation: A 28-yr-old male Naval Flight Officer experienced loss of consciousness at a morning

briefing, but immediately returned to normal except for tachycardia. He suffered a second episode at a base hospital while on a cardiac monitor. The rhythm was diagnosed as complete heart block and a permanent pacemaker was inserted. This condition is considered disqualifying for U.S. Navy aviation duty. Conclusion: It is easy to dismiss a single episode of syncope in this age group as due to orthostasis, hangover, or other benign causes. Serious underlying pathology such as complete heart block is rare. The threat to safety of flight, however, dictates that all episodes of syncope in aviators receive a thorough diagnostic work-up.
DTIC
Aerospace Medicine; Aircraft Pilots; Aircraft Safety; Flight Safety; Heart; Military Aviation; Symbols; Syncope

20100019713 Federal Aviation Administration, Washington, DC USA
Effects of Video Weather Training Products, Web-Based Preflight Weather Briefing, and Local Versus Non-Local Pilots on General Aviation Pilot Weather Knowledge and Flight Behavior. Phase 1
Knecht, William; Ball, Jerry; Lenz, Michael; Jan 2010; 39 pp.; In English
Report No.(s): AD-A519022; DOT-FAA-AM-10-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519022

This research has two main phases. Phase 1 investigated three major questions: 1) Do video weather training products significantly affect general aviation (GA) pilot weather knowledge and flight behavior in marginal meteorological conditions? 2) How are modern Web-based weather products used during GA preflight briefing? 3) Do local Oklahoma GA pilots differ appreciably from other pilots in either weather knowledge or weather-related flight behavior? Fifty GA pilots took a general weather knowledge pre-test, followed by exposure to either one of two weather training videos (the Experimental groups) or to a video having nothing to do with weather (the Control group). They next took a post-test to measure knowledge gain induced by the training product. Finally, they planned for, and flew, a simulated flight mission through marginal weather from Amarillo, TX, to Albuquerque, NM. Question 1: Few highly significant, direct effects were found for the two 90-minute video weather training products all by themselves. Follow-up multivariate modeling implied that a combination of higher pilot age, receiving either weather training product, and takeoff hesitancy could significantly, correctly predict 86.7% of diversions from deteriorating weather and 77.8% of full flight completions. However, we must conservatively conclude that weather knowledge and GA weather flying behavior are complex and unlikely to be profoundly changed by a single, brief training product. Phase 2 will address this issue. Question 2: The data-collecting emulation of www.aviationweather.gov suggested that mere time spent on preflight briefing was not a good predictor of either quality of preflight briefing or subsequent flight safety. Nonetheless, these data are just an opening look at what should eventually be a far more intensive study of modern weather briefing and its relation to flight safe.
DTIC
Aircraft Safety; Civil Aviation; Education; Flight Characteristics; Flight Conditions; Flight Safety; General Aviation Aircraft; Pilots; Weather

20100019714 Federal Aviation Administration, Washington, DC USA
Effects of Video Weather Training Products, Web-Based Preflight Weather Briefing, and Local Versus Non-Local Pilots on General Aviation Pilot Weather Knowledge and Flight Behavior. Phase 2
Knecht, William; Ball, Jerry; Lenz, Michael; Mar 2010; 24 pp.; In English
Report No.(s): AD-A519023; DOT-FAA-AM-10-6; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519023

This research had two main phases. Phase 1 investigated three major questions, one of which was whether or not video weather training products could significantly affect general aviation (GA) pilot weather knowledge and flight behavior in marginal meteorological conditions. Fifty GA pilots took a general weather knowledge pre-test, followed by exposure to either one of two weather training videos (the Experimental groups) or to a video having nothing to do with weather (the Control group). They next took a post-test to measure knowledge gain induced by the training product. Finally, they planned for and flew a simulated flight mission through marginal weather from Amarillo, TX, to Albuquerque, NM. Multivariate modeling implied that a combination of higher pilot age, receiving either weather training product, and takeoff hesitancy could significantly, correctly predict 86.7% of diversions from deteriorating weather and 77.8% of full flight completions. The question then became whether or not this model would be robust over time. In the present study (Phase 2), after a time lapse of 3-4 months, 44 of the 50 original Phase 1 pilots returned for further testing. Again, they were tested for weather knowledge and flew a simulated flight mission similar to Phase 1's. No significant change in weather knowledge was evident from Phase 1 to 2, nor were any significant differences seen between the three treatment groups. Additionally, the 3-factor model of Phase 1 failed to significantly predict flight diversions or flight completions in Phase 2. The combined results of Phases 1 and 2 imply

that the effects on weather knowledge and flight behavior of a single 90-minute training video seem minimal in comparison to the complexities of weather itself and flight into weather. This is consistent with intuition. Moreover, what small effects are produced seem to decay with None of this is unexpected. It merely means that weather is comple
DTIC
Aircraft Safety; Civil Aviation; Education; Flight Characteristics; Flight Conditions; Flight Safety; General Aviation Aircraft; Pilots; Weather

20100019873 Naval War Coll., Newport, RI USA
The U.S. Navy's Transition to Jets
Rubel, Robert C; Jan 2010; 12 pp.; In English
Report No.(s): AD-A519326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When the U.S. Navy introduced its first operational jet, the McDonnell F1H Phantom, in 1947, it began a transition phase that turned out to be extended and very costly in terms of aircrew lives and airplanes lost. The higher speeds and altitudes of jets presented a new set of problems to the aircraft designers and manufacturers, as well as to the Navy squadrons that operated them. In 1946, nobody knew that a high-performance jet fighter needed such appurtenances as a stabilator (instead of an elevator); irreversible, hydraulic flight controls with artificial feel; redundant hydraulic systems; pitch and yaw stability augmentation; ejection seats; air conditioning; and others. Learning these lessons required a trial-and-error process that resulted in the fielding and rapid obsolescence of a series of different jets, each reflecting solutions to the defects discovered in earlier models. It is central to the story presented in this article to consider how long this transition to jets lasted. This article argues that tactical jet aircraft design and technology presented Navy aircrews, maintenance personnel, and leaders with several major challenges that were in fact not substantially overcome until the introduction of the F/A-18 Hornet in 1983.
DTIC
Jet Aircraft; Military Aircraft

20100020188 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Particulate Characterization and Control Evaluation for Carbon Fiber Composite Aircraft Crash Recovery Operations
Ferreri, Matthew R.; March 2010; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518994; AFIT/GIH/ENV/10-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518994

Within the USA Air Force (USAF) Advanced Composite Material (ACM) is gaining an increasing use in military aircraft. With the number of aircraft that have increasingly large amounts of ACM materials, the probability of an incident with one of these aircraft also increases. When such an incident occurs the aircraft needs to be disassembled, removed, and later inspected as part of the accident investigation process. This disassembly process is termed ?Crash Recovery Operations.? Carbon fibers have been shown to be hazardous to human health and a pilot study raised the suspicion that nanosized aerosol may be generated during the cutting of carbon fiber panels. Due to this, a bench top study was conducted to evaluate the effectiveness of several fiber controls. Additionally, an evaluation of a number of direct reading instruments and traditional gravimetric sampling techniques were evaluated to determine a sampling protocol for evaluation composite fibers. A statistically significant (F-value = 0.0001) shift towards larger diameters in the idealized particle size distribution was shown for both wetted water and water controls when compared to a baseline of no control when cutting burnt ACM. Recommendations for future evaluation and control of composite fiber processes were made.
DTIC
Aircraft Structures; Carbon Fibers; Characterization; Composite Materials; Composite Structures; Crashes; Fiber Composites; Particulates

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes all modes of communication with and between aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 06 Avionics and Aircraft Instrumentation; 17 Space Communications, Spacecraft Communications, Command and Tracking; and 32 Communications and Radar.

20100019779 Marine Corps Development and Education Command, Quantico, VA USA
Remodeling the Marine Air Traffic Control Officer Training Progression
Coble, C M; Jan 7, 2008; 15 pp.; In English
Report No.(s): AD-A519217; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519217

The current Marine Air Traffic Control Officer (MATCO) training progression does not adequately prepare its officers to fill many Air Traffic Control (ATC) billets. Nonstandardization and diversity in training creates officers of unequal skill and comprehension levels. Remodeling the ATC MOS training progression will improve the safety of flight at Marine Corps air stations and deployed forward operating bases (FOBs) while tremendously enhancing ATC interface within the Marine Air Command and Control System (MACCS).
DTIC
Air Traffic Controllers (Personnel); Education

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes all stages of design of aircraft and aircraft structures and systems. Also includes aircraft testing, performance and evaluation, and aircraft and flight simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Technology Utilization and Surface Transportation.

20100018612 Naval Research Lab., Washington, DC USA
Vantage (trademark) Unmanned Air Vehicle
Southwick, J R; Jan 2008; 3 pp.; In English
Report No.(s): AD-A517687; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517687

The Vehicle Research Section (VRS) at the Naval Research Laboratory (NRL) in Washington, DC, has been developing airborne unmanned air platforms to support electronic warfare (EW) and intelligence, surveillance, and reconnaissance (ISR) missions for over 30 years. The Vantage(trademark) unmanned air vehicle (UAV) is one such platform. Here at NRL the goal is to push technology and develop concept vehicles that can be transitioned into industry to better meet the needs of the Armed Forces. NRL conceives and develops designs for the technologically advanced warfare needs of the future.
DTIC
Drone Vehicles; Helicopters

20100018651 Library of Congress, Washington, DC USA
Federal Aviation Administration (FAA) Reauthorization: An Overview of Legislative Action in the 111th Congress
Elias, Bart; Mar 22, 2010; 83 pp.; In English
Report No.(s): AD-A517787; CRS-7-5700; CRS-R40410; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517787

Funding authorization for aviation programs set forth in Vision 100-Century of Aviation Reauthorization Act (P.L. 108-176) and authorization for taxes and fees that provide revenue for the aviation trust fund expired at the end of FY2007. While Federal Aviation Administration (FAA) reauthorization legislation was considered during the 110th Congress, the only related legislation enacted consisted of several short-term extensions for aviation trust fund revenue collections and aviation program authority. The Federal Aviation Administration Extension Act, Part II (P.L. 110-330) extended these authorizations until March 31, 2009, thus carrying the issue of FAA reauthorization over to the 111th Congress. On March 30, 2009, the Federal Aviation Administration Extension Act of 2009 (P.L. 111-12) was enacted, further extending revenue collections and aviation program authority through the end of FY2009, and on October 1, 2009, the Fiscal Year 2010 Federal Aviation Administration Extension Act (P.L. 111-69) was enacted, further extending this authority through the end of calendar year

2009. On December 16, 2009, the Fiscal Year 2010 Federal Aviation Administration Extension Act, Part II (P.L. 111-116) was enacted further extending the existing authority until March 31, 2010.
DTIC
General Aviation Aircraft; Revenue

20100018652 Marine Corps Development and Education Command, Quantico, VA USA
Joint Strike Fighter, the Right Choice for the Future Norwegian Air Force
Engen, Stein; Feb 20, 2009; 14 pp.; In English
Report No.(s): AD-A517789; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517789

The Norwegian government's decision to purchase the Lockheed Martin F-35 Joint Strike Fighter (JSF) promises to be the largest governmental contract in Norwegian history. According to official figures released to the press, the 48 JSFs will come at a cost of approximately 18 billion Norwegian kroner (NOK), and a life-cycle cost of 130 billion NOK over 30 years. This controversial decision has incited zealous infighting among the Norwegian people. Many Norwegians believe that such a large contract should have been awarded to a European producer for either the Eurofighter or the Swedish JAS 39 Grippen. The author contends, however, that the Norwegian government's decision to purchase the F-35 was the correct one. The F-35 Joint Strike Fighter is the best aircraft for the future of the Norwegian Air Force because it not only offers superior airframe performance, stealth capability, and interoperability, but it also will ensure predictable security politics in the future. The focus of this paper will be the security cooperation aspects of the purchase. Though other important issues have been taken into consideration, such as cost and airframe capabilities, these issues fell dead as the final report stated that the JSF was militarily superior and less expensive than the Swedish alternative. The most important aspect of the transaction is its effect on Norwegian security politics. Being a small country, Norway's relationship to its allies is important, and the JSF contract will keep Norway's relationship to the USA and NATO in good standing.
DTIC
Fighter Aircraft; Norway; Procurement; Security; Selection; United States

20100018654 Marine Corps Development and Education Command, Quantico, VA USA
An Argument for the Keyhole Template for Close Air Support on the Urban Battlefield
Taggart, B T; Mar 4, 2009; 14 pp.; In English
Report No.(s): AD-A517794; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517794

The current doctrine for close air support (CAS) does not delineate between the open battlefield and that of the cluttered and confusing canyons of the urban environment. Current CAS doctrine calls for Pre-spun Initial Points (IP), or a point from which an attack aircraft begins its attack, in all CAS environments. IPs may not always be feasible in an environment where the target area is small and the supporting aircraft are many. The keyhole CAS template is the key to successful execution of targets in urban terrain using air delivered fires. The keyhole CAS template should be doctrine for all urban close air support requirements.
DTIC
Cities; Fires; Support Systems; Templates

20100018657 Marine Corps Development and Education Command, Quantico, VA USA
Integration of the F-35C into Marine Corps Acquisition Plans
Zarra, J M; Feb 20, 2009; 15 pp.; In English
Report No.(s): AD-A517799; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517799

In current combat operations, three different Marine Corps fixed-wing platforms provide offensive air support (OAS) in Iraq and Afghanistan. In the near future, the Marine Corps intends to provide air support to the Marine-air- ground-task-force (MAGTF) with a single variant of aircraft, the F-35B Joint Strike Fighter (JSF). By doing so, the Corps will be relying heavily on one aircraft to fulfill the roles of multiple platform capabilities. While operating from either a forward operating base (FOB), or from the flight deck of a ship, the Marine Corps needs to scrutinize the capabilities of the aircraft carrier variant F-35C. Historically, the MAGTF has relied on many aircraft for supporting troops on the ground. In the 1960's, the Marine Corps possessed the capabilities provided by the A-4 Skyhawk, the F-4 Phantom, and the A-6 Intruder. Modern strike aircraft such as the AV-8B Harrier II and the F/A-18C/D Hornet support the MAGTF today. The introduction of the JSF will present

a few challenges. The F-35B Short Take-Off Vertical Landing (STOVL) model, designed mostly for close air support (CAS) missions, will have a hard time fulfilling all of the above platforms' capabilities.
DTIC
Aircraft Configurations; Fixed Wings

20100018711 Naval Postgraduate School, Monterey, CA USA
Development and Testing of the Miniature Aerial Delivery System Snowflake
Yakimenko, Oleg A; Slegers, Nathan J; Tiaden, Robyn A; May 7, 2009; 16 pp.; In English
Report No.(s): AD-A517947; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517947

This paper discusses the current status of the development of the miniature aerial delivery system to be further employed in a variety of different research projects. It starts from the overall description of the system and proceeds with the discussion of the test results performed so far. Specifically, it addresses the effects of the changing ground winds on touchdown accuracy. The paper ends with conclusions and recommendations.
DTIC
Air Cargo; Delivery; Miniaturization; Test Stands

20100018784 Carnegie-Mellon Univ., Pittsburgh, PA USA
Passive, Long-Range Detection of Aircraft: Towards a Field Deployable Sense and Avoid System
Dey, Debadeepta; Geyer, Christopher; Singh, Sanjiv; Digioia, Matt; Jul 2009; 11 pp.; In English
Contract(s)/Grant(s): W91CRB-04-C-0046
Report No.(s): AD-A518105; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518105

Unmanned Aerial Vehicles (UAVs) typically fly blind with operators in distant locations. Most UAVs are too small to carry a traffic collision avoidance system (TCAS) payload or transponder. Collision avoidance is currently done by flight planning, use of ground or air based human observers and segregated air spaces. US lawmakers propose commercial unmanned aerial systems access to national airspace (NAS) by 30th September 2013. UAVs must not degrade the existing safety of the NAS, but the metrics that determine this have to be fully determined yet. It is still possible to state functional requirements and determine some performance minimums. For both manned and unmanned aircraft to fly safely in the same airspace UAVs will need to detect other aircraft and follow the same rules as human pilots. Key specifications of the international committee F38 on UAS systems standard F2411-04 (1) proposed requirements which include a field of regard of 220 degrees (horizontal) x 30 degrees (vertical), minimum detection range of 3 statute miles under visual flight rules and a required miss distance of 500 feet. Without this capability, widespread utilization of UAVs will not be possible.
DTIC
Air Traffic; Aircraft Detection; Collision Avoidance; Pilotless Aircraft; Traffic; Transponders

20100018893 Naval Postgraduate School, Monterey, CA USA
Towards a Low-Cost Quadrotor Research Platform
Burkamshaw, Leon K; Mar 2010; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518360; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two aspects of currently available Miniature UAVs (MUAVs) that limit the adoption of this technology for civil and research purposes are the high cost and closed design philosophy. This thesis attempts to solve these problems by presenting an open source design that is focused on low-cost, while maintaining a reasonable level of performance. The use of Commercial Off-The-Shelf (COTS) equipment is maximized where possible to reduce development time and cost. A novel approach used by this design is the use of a Nintendo Wii MotionPlus device as an Inertial Measurement Unit (IMU). This mass produced COTS part provides a three degree of freedom IMU for minimal cost. All software is of a modular design to ease understanding and facilitate improvements. To reduce development time, and to help discover requirements, a Rapid Application Development (RAD) methodology has been adopted that is suitable for implementation by a single developer. Software prototypes are constructed and iteratively built upon to discover more requirements. At the completion of each phase, testing is performed. Once a suitable level of maturity has been reached, the software prototype is rolled into the main build. Flight-testing is performed at the completion of the design along with a quantitative measure of flight stability.
DTIC
Commercial Off-the-Shelf Products; Design Analysis; Helicopters; Inertial Platforms; Low Cost

20100018945 RAND Corp., Santa Monica, CA USA

A Repair Network Concept for Air Force Maintenance: Conclusions from Analysis of C-130, F-16, and KC-135 Fleets

Tripp, Robert S; McGarvey, Ronald G; Van Roo, Ben D; Masters, James M; Sollinger, Jerry M; Jan 2010; 64 pp.; In English

Contract(s)/Grant(s): FA7014-06-C-0001

Report No.(s): AD-A518524; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent Office of the Secretary of Defense (OSD) planning guidance directs the services to plan for high levels of engagement and deployed operations, although their nature, locations, durations, and intensity may be unknown. Recognizing that this new guidance might impose different demands on the logistics system, senior Air Force logistics leaders asked RAND Project AIR FORCE to undertake a logistics enterprise analysis. This analysis aims to identify and rethink the basic issues and premises on which the Air Force plans, organizes, and operates its logistics enterprise. This monograph synthesizes the results of the initial phases of the logistics enterprise study. It describes an analysis of repair network options to support three series of aircraft: C-130, KC-135, and F-16. It assesses the effect of consolidating certain scheduled maintenance tasks and off-equipment component repair at centralized repair facilities. It also discusses an initial assessment of maintenance concepts that integrate wing-level and depot-level maintenance processes.

DTIC

C-135 Aircraft; F-16 Aircraft; Logistics; Maintenance; Workloads (Psychophysiology)

20100018980 Naval Postgraduate School, Monterey, CA USA

Carrier Air Wing Tactics Incorporating Navy Unmanned Combat Air System (NUCAS)

Gill, Travis J; Mar 2010; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518620; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Navy has established a Program Office for Acquisition, PMA-268, to develop the Navy Unmanned Combat Air System (NUCAS). The NUCAS will be a fighter-sized aircraft capable of a variety of missions including deep-strike, Intelligence Surveillance and Reconnaissance (ISR), Time Sensitive Targeting (TST) and Air-to-Air Refueling (AAR). The NUCAS will offer new capabilities to the operability of a Carrier Air Wing (CAW). Potential benefits include improvements in combat sortie completion rate for manned aircraft such as the F/A-18 Super Hornet and the F-35C Lighting II Joint Strike Fighter (JSF). In this thesis, we evaluate a strike scenario that focuses on the coordination of the NUCAS, the F/A-18 Super Hornet, and the F-35C Lightning II. We construct a simulation model of the scenario, and use a designed experiment to run 12,000 simulated coordinated strike events. We then use a variety of statistical and graphical tools to evaluate the result in order to determine the quantity of aircraft required for mission success, and operational factors necessary to limit friendly aircraft losses. The results indicate that a division of four NUCAS aircraft is advantageous, in terms of achieved high target casualty rates and high blue survivability rates. The results also highlight the necessity of stealth technology requirements in future aircraft development.

DTIC

Armed Forces (United States); Combat; Refueling; Remotely Piloted Vehicles; Tactics; Wings

20100018988 Naval Postgraduate School, Monterey, CA USA

P-8A Poseidon Multi-mission Maritime Aircraft (MMA) Software Maintenance Organization Concept Analysis

Naegle, Brad; Petross, Diana; Feb 25, 2010; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518634; NPS-GSBPP-10-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Navy is developing a replacement system, designated as the P-8 Poseidon, for the aging P-3C Orion fleet of aircraft, expanding the mission profile to meet the requirements for its Multi-mission Maritime Aircraft (MMA). The Incremental acquisition approach leverages the Commercial-Off-The-Shelf (COTS) concept, using a modified Boeing 737 aircraft system. The concept integrates the COTS components with Government-Off-The-Shelf (GOTS) elements, including offensive and defensive systems, mission packages, and Operational Flight Profiles (OFP), as well as some newly developed systems. The COTS, GOTS, and newly developed systems are all software-intensive and drive the need for an effective software support architecture that necessarily combines commercial and Governmental entities. This research analyzes potential system software maintenance drivers, and presents advantages and disadvantages for three differing software support management options. The conclusions reached lead the researchers to recommend that an organic (Navy) software support management structure would be most advantageous.

DTIC

Architecture (Computers); Commercial Off-the-Shelf Products; Computer Programs; Maintenance; Military Aircraft

20100019037 BNM-Laboratoire Primaire du Temps et des Frequencies, Paris, France

Time Aspects of the European Complement to GPS: Continental and Transatlantic Experimental Phases

Uhrich, P; Juompan, B; Tourde, R; Brunet, M; Dutrey, J F; Dec 1994; 15 pp.; In English

Report No.(s): AD-A518801; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The CNES project of a European Complement to GPS [CE-GPS] is conceived to fullfill the needs of Civil Aviation for a non-precise approach phase with GPS as sole navigation means. This generates two missions: a monitoring mission - alarm of failure -, and a navigation mission - generating a GPS-like signal on board the geostationary satellites. The host satellites will be the Inmarsat constellation. The CE-GPS missions lead to some time requirements, mainly the accuracy of GPS time restitution and of monitoring clock synchronization. To demonstrate that the requirements of the CE-GPS could be achieved, including the time aspects, an experiment has been scheduled over the last two years, using a part of the Inmarsat II F-2 payload and specially designed ground stations based on 10 channels GPS receivers. This paper presents a review of the results obtained during the continental phase of the CE-GPS experiment with two stations in France, along with some experimental results obtained during the transatlantic phase (three stations in France, French Guyana, and South Africa). It describes the synchronization of the monitoring clocks using the GPS Common-view or the C- to L-Band transponder of the Inmarsat satellite, with an estimated accuracy better than 10 ns (1 sigma).

DTIC

Civil Aviation; Clocks; Global Positioning System

20100019185 Dayton Univ. Research Inst., OH USA; Air Force Research Lab., Wright-Patterson AFB, OH, USA

The Effect of Diethylene Glycol Monomethyl Ether (DiEGME) on Microbial Contamination of Jet Fuel: A Minimum Concentration Study

Balster, Lori M.; Vangsness, Marlin D.; Bowen, Loryn L.; Mueller, Susan S.; Brown, Lisa M.; Strobel, Ellen M.; Mar, 2010; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-03-2-2347; Proj-3048

Report No.(s): AD-A517851; AFRL-RZ-WP-TR-2010-2002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517851

Diethylene glycol monomethyl ether (DiEGME) is widely used in military aircraft to inhibit both fuel system icing and microbial growth. However, due to the cost of this additive and its deleterious effects of the additive, a study is being conducted to determine if it is possible to reduce the concentration of DiEGME in military aircraft fuel. The study presented here was conducted to support the larger study investigating the possible impact of lowering the DiEGME level from 0.05-0.15% to 0.00-0.05% by volume in the fuel phase. The study presented here was confined to the impact upon the biocidal/biostatic properties of the additive. This study suggests that a minimum of 0.01-0.02% DiEGME is needed to retain biocidal/biostatic effectiveness.

DTIC

Aircraft Fuels; Contaminants; Contamination; Ethers; Ethylene Compounds; Glycols; Ice Formation; Methyl Compounds; Microorganisms; Radicals

20100019313 NASA Langley Research Center, Hampton, VA, USA

Full-Scale Crash Test of a MD-500 Helicopter with Deployable Energy Absorbers

Kellas, Sotiris; Jackson, Karen E.; Littell, Justin D.; May 11, 2010; 12 pp.; In English; American Helicopter Society (AHS) 66th Annual Forum and Technology Display, 11-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.05.02.01

Report No.(s): NF1676L-9517; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019313

A new externally deployable energy absorbing system was demonstrated during a full-scale crash test of an MD-500 helicopter. The deployable system is a honeycomb structure and utilizes composite materials in its construction. A set of two Deployable Energy Absorbers (DEAs) were fitted on the MD-500 helicopter for the full-scale crash demonstration. Four anthropomorphic dummy occupants were also used to assess human survivability. A demonstration test was performed at NASA Langley's Landing and Impact Research Facility (LandIR). The test involved impacting the helicopter on a concrete surface with combined forward and vertical velocity components of 40-ft/s and 26-ft/s, respectively. The objectives of the test were to evaluate the performance of the DEA concept under realistic crash conditions and to generate test data for validation of dynamic finite element simulations. Descriptions of this test as well as other component and full-scale tests leading to the helicopter test are discussed. Acceleration data from the anthropomorphic dummies showed that dynamic loads were

successfully attenuated to within non-injurious levels. Moreover, the airframe itself survived the relatively severe impact and was retested to provide baseline data for comparison for cases with and without DEAs.
Author
Helicopters; Impact Loads; Crashworthiness; Airframes; Honeycomb Structures; Energy Absorption; Dynamic Loads; Composite Materials

20100019315 NASA Langley Research Center, Hampton, VA, USA
System-Integrated Finite Element Analysis of a Full-Scale Helicopter Crash Test with Deployable Energy Absorbers
Annett, Martin S.; Polanco, Michael A.; May 11, 2010; 16 pp.; In English; American Helicopter Society (AHS) 66th Annual Forum and Technology Display, 11-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 877868.02.07307.05.02.01
Report No.(s): NF1676L-10396; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019315

A full-scale crash test of an MD-500 helicopter was conducted in December 2009 at NASA Langley's Landing and Impact Research facility (LandIR). The MD-500 helicopter was fitted with a composite honeycomb Deployable Energy Absorber (DEA) and tested under vertical and horizontal impact velocities of 26-ft/sec and 40-ft/sec, respectively. The objectives of the test were to evaluate the performance of the DEA concept under realistic crash conditions and to generate test data for validation of a system integrated finite element model. In preparation for the full-scale crash test, a series of sub-scale and MD-500 mass simulator tests was conducted to evaluate the impact performances of various components, including a new crush tube and the DEA blocks. Parameters defined within the system integrated finite element model were determined from these tests. The objective of this paper is to summarize the finite element models developed and analyses performed, beginning with pre-test predictions and continuing through post-test validation.
Author
Crashworthiness; Helicopters; Impact Velocity; Finite Element Method; Energy Absorption; Impact Loads; Crashes; Landing Loads

20100019358 Army Unmanned Aircraft Systems Center of Excellence, Fort Rucker, AL USA
U.S. Army Unmanned Aircraft Systems Roadmap 2010-2035: Eyes of the Army
Apr. 9, 2010; 141 pp.; In English
Report No.(s): AD-A518437; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Unmanned Aircraft System (UAS) Roadmap outlines how the U.S. Army will develop, organize, and employ UAS from 2010 to 2035 across full spectrum operations. The Army UAS Roadmap is nested with the Unmanned Systems (UMS) Initial Capabilities Document (ICD) and capitalizes on UAS capabilities and emerging technologies so that the Warfighter can conduct missions more effectively with less risk. Experiences in Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) prove that UAS significantly augment mission accomplishment by reducing a Soldier's workload and their exposure to direct enemy contact. The UAS serve as unique tools for the commander, which broaden battlefield situational awareness and ability to see, target, and destroy the enemy by providing actionable intelligence to the lowest tactical levels. Unmanned platforms are the emerging lethal and non-lethal weapons of choice that will continue to transform how the Army prosecutes future operations and ultimately save lives. The eventual employment of sustainment/cargo UAS will ensure responsive and uninterrupted sustainment support ultimately increasing freedom of action and operational reach. The Roadmap, although not directive in nature, is a living document that factually and conceptually benchmarks the Army's UAS strategy for the next 25 years and provides a common vision for all organizations responsible for synchronizing this transformation.
DTIC
Aircraft; Drone Vehicles; Unmanned Aircraft Systems

20100019359 Naval Surface Warfare Center, Bethesda, MD USA
UAV Mothership
Bradley, Cayle; Daniel, Joanne; Hanks, Daniel; McKelvey, Joanmarie; Raanan, Josh; Jul. 2009; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518429; NSWCCD-CISD-2009/004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unmanned Aerial Vehicle (UAV) technologies have been rapidly advancing. Compact in size, diverse in application, and

capable of autonomous operation, UAVs are appealing for a variety of military missions. The U.S. Navy is exploring the potential use of unmanned vehicle systems for intelligence gathering and reconnaissance missions such as Anti-Submarine Warfare, search and rescue, and combat surveillance. UAVs reduce the risk of human loss, reduce monetary risk, and have extended operational flexibility and endurance. Large scale swarms of UAVs could scan a much larger combat area in less time than traditional airborne systems. The U.S. Navy is currently reevaluating its approach to combat surveillance by modeling the effectiveness of a UAV swarm and may conclude that a swarm is indeed the most effective strategy. The need to integrate unmanned aerial systems on board a mothership capable of launching, recovering, commanding, and maintaining UAVs has driven the development of this concept ship designed around the function of its aircraft systems. It includes such features as automated shipboard fixed-wing UAV launching for fast deployment, a large helicopter flight deck for sequential vertical take-off, and catch nets that deploy from the flight deck for UAV recovery. The design presented in this study demonstrates the size and layout of a feasible ship that meets the demand for a UAV Mothership.
DTIC
Aircraft Configurations; Combat; Drone Vehicles; Dynamic Structural Analysis; Fixed Wings; Marine Technology; Pilotless Aircraft; Ships; Surveillance; Vertical Takeoff Aircraft

20100019464 Naval Air Systems Command (PMA-234), Patuxent River, MD USA
P-8A Poseidon Collaborative Simulation and Stimulation for Electromagnetic Environmental Effects Test and Evaluation
Achtellik, Paul; January 2008; 6 pp.; In English; 2007 Annual International Test and Evaluation Association (ITEA) Symposium, 12-15 Nov. 2007, Lihue, HI, USA
Report No.(s): AD-A517981; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517981

Over the past several decades, technological advances have provided the Naval Air Systems Command (NAVAIR) with exciting opportunities while creating significant challenges to those who design, test, and operate the complex mission systems found on today's war-fighting aircraft. The responses to these challenges are well underway and began with innovative planning and cost-wise construction of various next-generation facilities, conceptual planning of integrated and extensible network infrastructures, and the insistence on collaborative engineering across all phases of the acquisition life cycle. Today, the challenge continues and, in many aspects, has become even more difficult, stretching our fiscal, technological, and personnel resources to their limits. This article addresses one of the more difficult aspects of today's challenges: Conducting Ground-Based Full Spectrum Test & Evaluation on Next-Generation Systems.
DTIC
Electromagnetic Compatibility; Environment Effects; Simulation; Stimulation

20100019494 Department of Transportation, Cambridge, MA, USA
Review of Safety Report Involving Electronic Flight Bags
Chandra, Divya C.; Kendra, Andrew; April 2010; 35 pp.; In English
Report No.(s): PB2010-107559; DOT-VNTSC-FAA-10-08; DOT/FAA/AR-10/5; No Copyright; Avail.: CASI: A03, Hardcopy

Safety events in which Electronic Flight Bags (EFBs) were a factor are reviewed. Relevant reports were obtained from the public Aviation Safety Reporting System (ASRS) database and the National Transportation Safety Board (NTSB) accident report database. Of the 67 relevant ASRS reports identified, 32 pertain to use of chart software and 30 pertain to computation of flight performance. Operational outcomes/anomalies and underlying EFB issues are identified. Charts were often in use on the EFB when deviations in heading, altitude, or speed occurred. Zooming and panning the chart display can induce workload and may cause the pilot to miss important information. With flight performance calculations, anomalies included company policy deviations, incorrect computations, and runway incursions. Finally, some pilots who were new to the EFB mentioned that difficulty using the EFB contributed to the event. EFB-related findings from two NTSB accident reports are highlighted. Both of these identified use of an EFB for calculating landing distance as a contributing factor. One issue was that assumptions underlying the performance calculations on an EFB must be presented to the crew as clearly as on paper-based performance tables. A second issue was assessment of the adequacy of training and procedures for using EFB performance calculations functions.
NTIS
Bags; Charts; Flight Characteristics; Performance Prediction; Safety

20100019498 William J. Hughes Technical Center, Atlantic City, NJ, USA; SRA International, Inc., Linwood, NJ, USA
Flammability of In-Service Aircraft Thermal Acoustic Insulation Blankets
Lyon, Richard E.; Safronava, Natallia; Cahill, Patricia; Conover, Brian; February 2010; 39 pp.; In English
Report No.(s): PB2010-107545; DOT/FAA/AR-TN09/43; No Copyright; Avail.: National Technical Information Service (NTIS)

Thermal acoustic insulation blankets are widely used in commercial aircraft to provide thermal insulation and acoustic damping. This report examines the burning effects on the thermal acoustic insulation blankets retrieved from the EVA Airways Flight BR67 fire event. On February 23, 2008, passengers disembarking from EVA Airways Flight BR67 reported smoke in the cabin of the Boeing 747-400 after landing at Suvamabhumi International Airport in Bangkok, Thailand. An investigation of the incident revealed burned thermal acoustic insulation blankets. The level of contamination on the encapsulating films of the as-received insulation blankets varied greatly. Samples of the contaminated film from different locations were weighed to determine the areal weight of contamination, were ranked by visual inspection, and were characterized by microscale combustion calorimetry to determine the thermal combustion properties. Thermal acoustic insulation blankets were also tested for flammability as prescribed by Title 14 Code of Federal Regulations 25.853 and 25.855. It was found that the visible contamination ranged in areal weight up to 167 grams per square meter of film surface and had a heat of combustion of 13 kJ/g, which is half that of the underlying insulation bag film. All in-service blankets and film samples passed the required 12-second vertical Bunsen burner test for flame resistance. The contaminated blankets did not pass the voluntary guideline for flame spread. Numerical modeling of the burning rate of contaminated blankets was conducted to help explain the flame spread results.
NTIS
Absorbers (Materials); Acoustic Attenuation; Flammability; Services; Sound Waves; Thermal Insulation

20100019555 Congressional Research Service, Washington, DC, USA
Aviation and Climate Change
McCarthy, J. E.; Jan. 27, 2010; 14 pp.; In English
Report No.(s): PB2010-108730; CRS/R-40090; No Copyright; Avail.: CASI: A03, Hardcopy

Aircraft are a significant source of greenhouse gases-compounds that trap the sun's heat, with effects on the Earth's climate. In the USA, aircraft of all kinds are estimated to emit between 2.6% and 3.4% of the nation's total greenhouse gas (GHG) emissions, depending on whether one counts international air travel. The impact of U.S. aviation on climate change is perhaps twice that size when other factors are considered. These include the contribution of aircraft emissions to ozone formation, the water vapor and soot that aircraft emit, and the high altitude location of the bulk of aircraft emissions. Worldwide, aviation is projected to be among the faster-growing GHG sources. This report provides background on aviation emissions and the factors affecting them; it discusses the tools available to control emissions, including existing authority under the Clean Air Act and proposed economy-wide cap-and-trade legislation; and it examines international regulatory developments that may affect U.S. commercial airlines. These include the European Union's Emissions Trading Scheme for greenhouse gases (EU-ETS), which is to include the aviation sector beginning in 2012, and discussions under the auspices of the International Civil Aviation Organization (ICAO).
NTIS
Air Pollution; Climate Change; Pollution Control

20100019637 Library of Congress, Washington, DC USA
F-35 Joint Strike Fighter (JSF) Program: Background, Status, and Issues
Bolkcom, Christopher; Jun 2, 2006; 29 pp.; In English
Report No.(s): AD-A518821; CRS-RL30563; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518821

The Defense Department's F-35 Joint Strike Fighter (JSF) is one of three aircraft programs at the center of current debate over tactical aviation, the others being the Air Force F-22A fighter and the Navy F/A-18E/F fighter/attack plane. In November 1996, the Defense Department selected two major aerospace companies, Boeing and Lockheed Martin, to demonstrate competing designs for the JSF, a joint service and multi-role fighter/attack plane. On October 26, 2001, the Lockheed Martin team was selected to develop further and to produce a family of conventional take-off and landing (CTOL), carrier-capable (CV), and short take-off vertical landing (STOVL) aircraft for the U.S. Air Force, Navy, and Marine Corps and the U.K. Royal Navy as well as other allied services. Originally designated the Joint Advanced Strike Technology (JAST) program, the JSF program is a major issue in Congress because of concerns about its cost and budgetary impact, effects on the defense industrial base, and implications for U.S. national security in the early 21st century. The JAST/JSF program evolved in response to the

high cost of tactical aviation, the need to deploy fewer types of aircraft to reduce acquisition and operating costs, and current projections of future threat scenarios and enemy capabilities. The program's rationale and primary emphasis is joint-service development of a next generation multi-role aircraft that can be produced in affordable variants to meet different operational requirements. Developing an affordable tri-service family of CTOL and STOVL aircraft with different combat missions poses major technological challenges. This report discusses the background, status, and current issues of the JSF program.
DTIC
Aircraft Design; Amount; Cost Estimates; Fighter Aircraft; Government Procurement; Procurement

20100019686 Auburn Univ., AL USA
Evaluation of the Effects of Hydrogen Peroxide on Common Aircraft Electrical Materials
Loo, Sin Ming; Kiepert, Josh; Klein, Derek; Pook, Michael; Chou, Shih-Feng; Overfelt, Tony; Watson, Jean; Mar 2010; 18 pp.; In English
Report No.(s): AD-A518975; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518975

Aircraft can be contaminated with unwanted chemical or biological elements. For years, hydrogen peroxide has been used to disinfect equipment in the medical community. The diluted vapor form of hydrogen peroxide is being considered for use as a decontaminant/disinfectant/sanitizer of transportation vehicles aircraft, buses, subway trains, ambulances, etc. Previous work showed that STERIS Corporation's Vaporized Hydrogen Peroxide (VHP(registered trademark)) technology could be used successfully in complex transportation vehicles. However, the compatibility of the process with typical aircraft avionics has not been established. This report documents a preliminary evaluation of the effects of hydrogen peroxide exposure on avionics (i.e., avionics wires, active circuit boards, and dummy circuit boards).
DTIC
Avionics; Compatibility; Hydrogen Peroxide; Vaporizing

20100019706 Naval Research Lab., Bay Saint Louis, MS USA
Littoral Environmental Reconnaissance Using Tactical Imagery From Unmanned Aircraft Systems
Holland, K T; Lalejini, David M; Spansel, Steven D; Holman, Robert A; Jan 2010; 9 pp.; In English
Report No.(s): AD-A519009; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519009

The dynamic nature of littoral regions requires a reconnaissance approach that can rapidly quantify environmental conditions. Inadequate estimation of these conditions can have substantial impacts on the performance of Naval systems. Given that expeditionary warfare operations can occur over timescales on the order of hours, exploitation of video imagery from tactical vehicles such as Unmanned Aircraft Systems (UAS) has proved to be a reliable and adaptive solution. Tactical littoral products that can be created by exploiting UAS imagery include estimates of surf conditions, dominant wave period, wave direction, nearshore currents, and bathymetry. These vehicles can fly for durations of 1-2 hours at altitudes of less than 1000 m (beneath typical cloud cover) to obtain imagery at pixel resolutions better than 1 m. The main advantage of using imaging sensors carried by these vehicles is that the data is available in the region of operational interest where other data collection approaches would be difficult or impossible to employ. The through-the-sensor exploitation technique we have developed operates in two phases. The first step is to align individual image frames to a common reference and then georegister the alignment into a mapped image sequence. The second phase involves signal processing of pixel intensity time series (virtual sensors) to determine spatial relationships over time. Geophysical relationships, such as linear wave dispersion, can then be applied to these processed data to invert for environmental parameters such as bathymetry.
DTIC
Bathymeters; Imagery; Ocean Currents; Reconnaissance; Regions; Unmanned Aircraft Systems

20100019710 Library of Congress, Washington, DC USA
Federal Aviation Administration (FAA) Reauthorization: An Overview of Legislative Action in the 111th Congress
Elias, Bart; Mar 30, 2010; 93 pp.; In English
Report No.(s): AD-A519015; CRS-R40410; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519015

Funding authorization for aviation programs set forth in Vision 100-Century of Aviation Reauthorization Act (P.L. 108-176) and authorization for taxes and fees that provide revenue for the aviation trust fund expired at the end of FY2007. While Federal Aviation Administration (FAA) reauthorization legislation was considered during the 110th Congress, the only

related legislation enacted consisted of several short-term extensions for aviation trust fund revenue collections and aviation program authority, thus carrying the issue of FAA reauthorization over to the 111th Congress. While FAA reauthorization debate has continued during the 111th Congress, additional short-term extensions have been passed to extend the authorization of aviation programs, funding, and aviation trust fund revenue collections.
DTIC
Aircraft Safety; Federal Budgets; Financial Management; Flight Safety; Law (Jurisprudence)

20100019788 Army Aviation Systems Command, Cleveland, OH USA
Performance of Advanced Heavy-Lift, High-Speed Rotorcraft Configurations
Johnson, Wayne; Yeo, Hyeonsoo; Acree, Jr, C W; Oct 2007; 29 pp.; In English
Report No.(s): AD-A519252; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519252

The aerodynamic performance of rotorcraft designed for heavy-lift and high-speed cruise is examined. Configurations considered include the tiltrotor, the compound helicopter, and the lift-offset rotor. Design conditions are hover and 250-350 knot cruise, at 5k/ISA+20 degrees Celsius (civil) or 4k/95 degrees Fahrenheit (military); with cruise conditions at 4000 or 30,000 ft. The performance was calculated using the comprehensive analysis CAMRAD II, emphasizing rotor optimization and performance, including wing-rotor interference. Aircraft performance was calculated using estimates of the aircraft drag and auxiliary propulsion efficiency. The performance metric is total power, in terms of equivalent aircraft lift-to-drag ratio L/D = WV/P for cruise, and figure of merit for hover.
DTIC
Aerodynamic Characteristics; Aerodynamic Configurations; Computer Programs; Helicopters; High Speed; Lift; Rotary Wing Aircraft

20100019865 Marine Corps Development and Education Command, Quantico, VA USA
Army Attack Aviation Shift of Training and Doctrine to Win the War of Tomorrow Effectively
Thornburg, Todd G; Jan 2009; 50 pp.; In English
Report No.(s): AD-A519290; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Army attack aviation leaders, through Training and Doctrine Command, should re-focus its primary mission in doctrine from the strategic/operational deep attack operations or deep interdiction attacks to close combat attacks (CCA) in order to support the ground commander's operational objectives in the current and future irregular warfare and conventional operations. Since the introduction of the AH-64A Apache Helicopters in the mid-1980s, the tank-killing Apaches trained to conduct deliberate deep attack operations 80 to 100 kilometers across the forward line of troops (FLOT) to destroy Soviet second echelon forces in order to prevent re-enforcement to the first echelon forces. This coincided with the Army's new AirLand Battle doctrine. The first battle in which the AH-64A Apache helicopter fought the deep attack mission was in Operation Desert Storm in 1991 against the Iraqi anti-aircraft radar systems to close the eyes of the enemy in order for the Air Force to conduct strategic attacks deep in Iraq. Since 2001, in Operation Enduring Freedom, the Apaches are fighting against an asymmetric warfighting enemy. This is a similar enemy where the first armed helicopter fired its first weapons platform against an insurgent enemy in Vietnam in 1962. The first armed helicopters provided close-armed protection in Vietnam and in today's battles, the attack aviation units are providing CCA. The Army conducted a deep attack mission during Operation Iraqi Freedom in 2003 during the initial phase to destroy elements of the Medina Division, but the lack of updated intelligence, bad weather, and misuse of SEAD ending up many aircraft damaged and one aircraft shot down with two POWs. The friction and fog of war will ultimately prevent the units from conducting the high-risk mission of crossing the FLOT deep into enemy territory.
DTIC
Attack Aircraft; Combat; Education; Military Helicopters; Military Operations

20100019958 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optimizing Aircraft Availability: Where to Spend Your Next O&M Dollar
Fry, Frederick G; Mar 2010; 87 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519537; AFIT/GCA/ENV/10-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the current fiscally constrained environment, the Air Force must allocate resources where they are most needed and will be most effectively used. For aircraft, this means spending money on weapon systems in a manner that optimizes aircraft

availability rates, thereby maximizing the warfighting capability of the Air Force. With that in mind, this thesis endeavors to improve the analytical capability of the Air Force by demonstrating a definitive link between operations and maintenance (O&M) spending and aircraft availability rates. To do that, explanatory regression models are developed that show the relationship between O&M spending and AA rates, while controlling for as many other significant variables as the data allow. Ultimately, this research was unable to show that aircraft availability rates are significantly influenced by changes in O&M spending; however, suggestions for future research and potential policy implications are discussed.
DTIC
Armed Forces (United States); Bomber Aircraft; Cost Analysis; Federal Budgets; Fighter Aircraft; Financial Management; Maintenance; Tanker Aircraft

20100020221 Eagle Applied Sciences, San Antonio, TX USA
Decompression Sickness and U-2 Operations: Summary of Research, Findings, and Recommendations Regarding Use of Exercise During Prebreathe
Webb, James T.; Woodrow, Andrew D.; Maresh, Ryan W.; March 2010; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8900-07-D-0001; F41624-97-D-6004
Report No.(s): AD-A518839; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518839

This report is designed to review the incorporation of methods and procedures for reducing the incidence of decompression sickness (DCS) during U-2 high altitude reconnaissance missions. Exercise During Prebreathe (EDP) during procedures used for some pilots preparing for U-2 high altitude operations is reviewed in detail. The published basis for enhancing prebreathe effectiveness with exercise is summarized along with an operational test with one U-2 pilot and survey results from 2 pilots. Successful incorporation of EDP on the International Space Station prior to extravehicular activity (EVA; space walks) is also reviewed. Procedures for its incorporation and variants in exercise equipment are summarized and equations for calculating individualized exercise parameters are shown. Included are summaries of peer-reviewed publications supporting this information and personal remarks about prebreathe procedures with EDP by National Aeronautic and Space Administration (NASA) Mission Specialists.
DTIC
Decompression Sickness; Oxygen; Physical Exercise; U-2 Aircraft

20100020270 Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Vertical Impact Tests of a Proposed B-52 Ejection Seat Cushion
Perry, Chris E.; July 2007; 42 pp.; In English
Contract(s)/Grant(s): Proj-7184; 62202F
Report No.(s): AD-A519316; DD0448021N0111; AFRL-RH-WP-TR-2010-0011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A series of vertical impact tests were conducted to compare the impact response of a proposed seat cushion to the response of the existing B-52 ejection seat cushion and a baseline no-cushion configuration. The vertical impact tests were conducted at a magnitude of 10 G using the AFRL/RHPA Vertical Deceleration Tower (VDT), and using a small and large instrumented manikin weighing approximately 103 lb and 217 lb respectively. Five impact tests were conducted per test configuration with each manikin. Instrumentation was used to measure manikin head and chest accelerations, seat pan and seat cushion accelerations, and seat pan and restraint system loads. The impact safety of the proposed cushion was determined by comparing peak seat cushion accelerations and peak seat pan loads. Any differences that were found in the peak loads and accelerations were related to a change in the probability of spinal injury, which was determined using the Dynamic Response Index. Evaluation of the data indicates that the proposed seat cushion slightly improved the response of the large manikin weighing 217 lb, and significantly improved the response of the small manikin weighing 103 lb. The small manikin's lumbar loads were reduced by approximately 20%. The risk of spinal injury for the small manikin was reduced by approximately 65% for an 18 G input simulating the B-52 catapult.
DTIC
Acceleration (Physics); B-52 Aircraft; Cushions; Ejection Seats; Impact Tests; Seats

20100020278 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Part Count: Monolithic Part Effects On Manufacturing Labor Cost, An Aircraft Applied Model
Lemke, Aaron M.; March 2010; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519654; AFIT/GFA/ENV/10-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There are significantly different manufacturing processes and part counts associated with composites that are not currently addressed within the procurement and life cycle management processes in the Department of Defense (DoD). A series of initiatives have culminated in significant evidence over the last decade to combat the implied risk of composite aircraft. An Air Force Research Labs program, Advanced Composite Cargo Aircraft (ACCA), provides substantial support for the impact of part size on life cycle cost on payload aircraft. This paper evaluates select current methods used and seeks to introduce modifications to the projected manufacturing hours cost. The findings suggest the impact of monolithic parts appears to permeate most of the major cost categories in development and production. The discussion addresses the far-reaching implications of trading several parts for one. This research finds that a significant relationship between relative part count and major cost categories does exist. Specifically, a percentage reduction in part count drives a corresponding percentage reduction in the manufacturing hours. The series of findings pertaining to part count and cost merit consideration for updates to the CERs and interim modifications to capture some portion of the impact in current life cycle cost models.
DTIC
Aircraft Models; Cost Analysis; Labor; Manufacturing; Mathematical Models

20100020288 Air Land and Sea Application Center (ALSA), Langley AFB, VA USA
The Air Land Sea Bulletin. Issue No. 2006-2, May 2006
May 2006; 25 pp.; In English
Report No.(s): AD-A519623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ALSA Center published the Air Land Sea Bulletin (ALSB) three times a year. The ALSB is a vehicle to spread the word on recent developments in warfighting concepts, issues, and Service interoperability. The intent is to provide a cross-Service flow of information among readers around the globe. Featured articles include: Joint Unmanned Aircraft Systems Center of Excellence Mission, US Air Force Predator UAVs Have Moved Into a More Overt Strike Role, Controlling CAS With the Predator: Is It Feasible?, Combat Teneta Key to Success of UAS at JNTC, UAS Support to Combat Search and Rescue (CSAR) Operations, and Global Area Reference System (GARS).
DTIC
Aircraft; Military Operations; Seas

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power; 28 Propellants and Fuels; and 44 Energy Production and Conversion.

20100018606 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Back-pressure Effect on Shock-Train Location in a Scramjet Engine Isolator
Paek, Richard I; Mar 2010; 195 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517638; AFIT/GAE/ENY/10-M17; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517638

The isolator of the scramjet decelerates the incoming high Mach flow to a lower Mach number and stabilizes the flow before it enters the combustor. Because of the unsteady combustion phenomenon and inconsistent completeness of the combustion, pressures within the combustor can vary drastically. These pressure variations can propagate forward and affect the flow field in the isolator - worst case unstarting the inlet. In this research, the shock train location VS. the back-pressure is examined experimentally. The back-pressure is artificially created by symmetric (top & bottom) ramps that can close the flow area. Raising/lowering ramps result in higher/lower back-pressure. Higher back-pressure moves the shock train forward, with too high a back-pressure causing un-start. This experiment is conducted for a variation in Reynolds number, ramp angle,

and two incoming Mach #s, and will result in a relationship between back-pressure and shock train location for various airflow conditions.
DTIC
Isolation; Isolators; Position (Location); Pressure; Pressure Effects; Ramjet Engines; Supersonic Combustion Ramjet Engines

20100018969 Naval Postgraduate School, Monterey, CA USA
Performance Characterization of Swept Ramp Obstacle Fields in Pulse Detonation Applications
Dvorak, William T; Mar 2010; 96 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pulse Detonation technology offers the potential for substantial increases in thrust and fuel efficiency in subsonic and supersonic flight Mach ranges through the use of a detonative vs. deflagrative combustion process. One of the approaches to reliably obtain a fuel-air detonation is to accelerate a deflagration combustion wave to detonation through the use of turbulence devices, known as detonation-to-deflagration transition. Current geometries for deflagration-to-detonation transition sacrifice much of the gains through losses from high velocity flows over obstacle fields required for detonation initiation. In this study, experimental swept ramp obstacle fields were characterized in an effort to realize decreased pressure losses while still creating the gas dynamic and turbulence necessary for detonation initiation. Characterization included measurement of pressure loss across the combustor during cold flow operation with no ignition or fuel present, and detonability testing that employed ion probe measurement of combustion wave velocity. Minimizing pressure losses existing in current designs will result in dramatic improvement of system performance. In addition to swept ramp fields, other configurations were analyzed using computational fluid dynamics (CFD) and subjected to performance testing. Of particular interest were obstacles of similar blockage area, but without the swept sides associated with streamwise vorticity in the flow field. Testing of unswept configurations allowed insight into the mechanisms for DDT and narrowed the field of practical obstacle geometries.
DTIC
Detonation; Pulsejet Engines

20100019175 NASA Glenn Research Center, Cleveland, OH, USA
Design and Implementation of a Characterization Test Rig for Evaluating High Bandwidth Liquid Fuel Flow Modulators
Saus, Joseph R.; Chang, Clarence T.; DeLaat, John C.; Vrnak, Daniel R.; April 2010; 23 pp.; In English; 45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 3-5 Aug. 2009, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 984754.02.07.03.19.04
Report No.(s): NASA/TM-2010-216105; AIAA Paper 2009-4886; E-17190; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019175

A test rig was designed and developed at the NASA Glenn Research Center (GRC) for the purpose of characterizing high bandwidth liquid fuel flow modulator candidates to determine their suitability for combustion instability control research. The test rig is capable of testing flow modulators at up to 600 psia supply pressure and flows of up to 2 gpm. The rig is designed to provide a quiescent flow into the test section in order to isolate the dynamic flow modulations produced by the test article. Both the fuel injector orifice downstream of the test article and the combustor are emulated. The effect of fuel delivery line lengths on modulator dynamic performance can be observed and modified to replicate actual fuel delivery systems. For simplicity, water is currently used as the working fluid, although future plans are to use jet fuel. The rig is instrumented for dynamic pressures and flows and a high-speed data system is used for dynamic data acquisition. Preliminary results have been obtained for one candidate flow modulator.
Author
Active Control; Combustion Stability; Liquid Fuels; Fuel Flow; Test Chambers; Dynamic Pressure; Fuel Systems; Modulators

20100019446 NASA Glenn Research Center, Cleveland, OH, USA
Fatigue Resistance of the Grain Size Transition Zone in a Dual Microstructure Superalloy Disk
Gabb, T. P.; Kantzos, P. T.; Telesman, J.; Gayda, J.; Sudbrack, C. K.; Palsa, B. S.; April 2010; 31 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698259.02.07,03.04.02
Report No.(s): NASA/TM-2010-216369; E-17305; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019446

Mechanical property requirements vary with location in nickel-based superalloy disks. To maximize the associated

mechanical properties, heat treatment methods have been developed for producing tailored microstructures. In this study, a specialized heat treatment method was applied to produce varying grain microstructures from the bore to the rim portions of a powder metallurgy processed nickel-based superalloy disk. The bore of the contoured disk consisted of fine grains to maximize strength and fatigue resistance at lower temperatures. The rim microstructure of the disk consisted of coarse grains for maximum resistance to creep and dwell crack growth at high temperatures up to 704 C. However, the fatigue resistance of the grain size transition zone was unclear, and needed to be evaluated. This zone was located as a band in the disk web between the bore and rim. Specimens were extracted parallel and transverse to the transition zone, and multiple fatigue tests were performed at 427 and 704 C. Mean fatigue lives were lower at 427 C than for 704 C. Specimen failures often initiated at relatively large grains, which failed on crystallographic facets. Grain size distributions were characterized in the specimens, and related to the grains initiating failures as well as location within the transition zone. Fatigue life decreased with increasing maximum grain size. Correspondingly, mean fatigue resistance of the transition zone was slightly higher than that of the rim, but lower than that of the bore. The scatter in limited tests of replicates was comparable for all transition zone locations examined.

Author

Heat Resistant Alloys; Nickel Alloys; Fatigue Life; Mechanical Properties; Crack Propagation; Creep Properties; Fracture Strength; Size Distribution; Powder Metallurgy; Heat Treatment

08
AIRCRAFT STABILITY AND CONTROL

Includes flight dynamics, aircraft handling qualities, piloting, flight controls, and autopilots. For related information see also 05 Aircraft Design, Testing and Performance; and 06 Avionics and Aircraft Instrumentation.

20100018813 Naval Research Lab., Washington, DC USA

Optical Guidance for Shoreline-Following UAVs

Kamgar-Parsi, B; Baker, P; Kahn, A; Kellogg, J; Jan 2007; 8 pp.; In English

Report No.(s): AD-A518210; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518210

Recent counterinsurgency combat operations in and around inland waters indicate the need for specialized technological capabilities to meet the unique challenges of warfighting in riverine theaters. The ability to conduct close surveillance of enemy activities in the riverine arena is of crucial importance to our warfighters. Over the past several years, the Information Technology Division, in collaboration with the Tactical Electronic Warfare Division, has been developing autonomous unmanned air vehicles (UAVs) capable of guiding their flight course along riverbanks and shorelines. Autonomous UAV guidance based on sensory input rather than GPS promises to increase the flexibility in tasking for single or multiple UAVs. This article describes a guidance and autopilot system that successfully navigated a curved shoreline. The project demonstrated that the near infrared spectrum is particularly good for navigating on shorelines since the land and water are easily distinguishable in these wavelengths, as are objects in the water. Also presented is a new control technique which is able to find control parameters in the image space. This overcomes the need for specialized edge extraction and path generation. Attitude control was maintained by the use of matched long wave infrared thermopiles.

DTIC

Automatic Pilots; Guidance (Motion); Navigation; Optical Equipment; Pilotless Aircraft; Shorelines

20100018814 Naval Research Lab., Washington, DC USA

The NRL Precision Orbital Transfer Vehicle

Johnson, M S; Morgan, S R; Vincent, W S; Gallelli, K H; Whalen, B P; Hope, A; Chappie, S S; Skalitzky, R G; Jan 2007; 5 pp.; In English

Report No.(s): AD-A518212; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518212

The NRL Naval Center for Space Technology (NCST) successfully completed and operated a low-cost advanced propulsion spacecraft designed for the precision orbital transfer of small satellites. This Upper Stage (U/S) launched on a Boeing Delta II from Cape Canaveral Air Force Station (CCAFS), Florida, in June 2006 and completed the transfer and release

of two experimental small satellites. NRL engineers operated the spacecraft from the NRL Blossom Point (BP) Mission Operations Center in southern Maryland.
DTIC
Artificial Satellites; Orbit Transfer Vehicles; Orbits; Precision

20100019983 California Univ., Berkeley, CA USA
Adaptive Coordinated Control of Intelligent Multi-Agent Teams
Sastry, S S; Kumar, R V; Choset, Howard M; Mar 4, 2010; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-1-0383
Report No.(s): AD-A519593; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this MURI program (ACCLIMATE) has been to develop adaptive, intelligent, and multi-agent control technologies to address the increasing concerns on the reliability, adaptability, and robustness of complex systems (such as unmanned air/ground vehicles) encountered on modern battlefields or in homeland defense. In particular, the program has been focused on the following three thrusts: 1. Architecture design of adaptive heterogeneous systems. We design novel system architectures that organically incorporate human intervention, and can be composed interoperably on the fly. 2. Integration of multi-sensor information into 3-D virtual environments for incorporating human intervention. 3. Handling uncertainty and adversarial intent in adaptive planning. In this final report, we summarize and highlight the key contributions of this program towards achieving the above fundamental goals.
DTIC
Adaptive Control; Drone Vehicles

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20100019445 NASA Glenn Research Center, Cleveland, OH, USA
Results and Conclusions from the NASA Isokinetic Total Water Content Probe 2009 IRT Test
Reehorst, Andrew; Brinker, David; April 2010; 32 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 645846.02.07.03,04.01
Report No.(s): NASA/TM-2010-216337; E-17274; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019445

The NASA Glenn Research Center has developed and tested a Total Water Content Isokinetic Sampling Probe. Since, by its nature, it is not sensitive to cloud water particle phase nor size, it is particularly attractive to support super-cooled large droplet and high ice water content aircraft icing studies. The instrument comprises the Sampling Probe, Sample Flow Control, and Water Vapor Measurement subsystems. Results and conclusions are presented from probe tests in the NASA Glenn Icing Research Tunnel (IRT) during January and February 2009. The use of reference probe heat and the control of air pressure in the water vapor measurement subsystem are discussed. Several run-time error sources were found to produce identifiable signatures that are presented and discussed. Some of the differences between measured Isokinetic Total Water Content Probe and IRT calibration seems to be caused by tunnel humidification and moisture/ice crystal blow around. Droplet size, airspeed, and liquid water content effects also appear to be present in the IRT calibration. Based upon test results, the authors provide recommendations for future Isokinetic Total Water Content Probe development.
Author
Aircraft Icing; Flow Measurement; Ice Formation; Moisture Content; Time Measurement; Gas Pressure; Control Systems Design; Atmospheric Pressure

12
ASTRONAUTICS (GENERAL)

Includes general research topics related to space flight and manned and unmanned space vehicles, platforms or objects launched into, or assembled in, outer space; and related components and equipment. Also includes manufacturing and maintenance of such vehicles or platforms. For specific topics in astronautics see *categories 13 through 20*. For extraterrestrial exploration see *91 Lunar and Planetary Science and Exploration*.

20100018502 FOI Defence Analysis, Stockholm, Sweden
Military Use of Space in a 10-20 Years Perspective
Lindstrom, Sandra; Andersson, Christer; November 2009; 48 pp.; In Swedish
Report No.(s): PB2010-107929; FOI-OI-R-2834; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is intended to clarify the future strategic role of space. The work draws particular attention to the impact on the use of space and international security in a 10-20 years perspective for some key players. The focus has been on describing military capabilities and ambitions in the space arena. Thus, industrial and technological aspects have been toned down.
NTIS
Aerospace Engineering; Management Planning; Security

20100018709 National Defense Univ., Washington, DC USA
Ensuring a Stable Space Domain for the 21st Century
Behlin, Thomas G; Jan 2007; 5 pp.; In English
Report No.(s): AD-A517941; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517941

For the past decade and a half, we have struggled to understand the meaning of space power, space superiority, and space dominance. Why is this? With a half century of space experience, why is it so challenging to understand these terms? What impact have these terms had on space activities? And as we increasingly depend upon orbiting spacecraft for national security and global prosperity, how can we help ensure stability for the space domain? These fundamental questions came to the fore during our work on the Quadrennial Defense Review (QDR). During the QDR, we observed the different views and priorities advocated by the various communities who have equities in space. To help come to terms with these questions and views, we asked the National Defense University to craft a space power theory that would be comparable to the theories that exist for other domains, for example, sea power. This is not the first time the U.S. Government has commissioned a space power theory study. The first study was chartered in the late 1990s, soon after the Air Force transitioned its doctrinal lexicon from roles, missions, and functions to one described by core competencies. That transition has taken us on a long journey, one in which we have struggled to understand what space power and space superiority--within the boundaries established by the Outer Space Treaty--mean for our nation. To help guide the contemporary work on a space power theory, we asked the study to focus on the underlying assumptions regarding why and how we as a society, nation, and military might use space to accomplish specific ends. We asked for a theory that addresses space power across the broad range of objectives that any space-faring state or nonstate actor may want to pursue and that explains the role of space in advancing national security objectives. And we asked for a theoretical framework to help judge the logic, significance, balance, and implications of space activities.
DTIC
Aerospace Engineering; Aerospace Systems

20100018713 National Defense Univ., Washington, DC USA
Space Strategy: A Call to Arms for the Sea Services
Klein, John J; Jan 2007; 5 pp.; In English
Report No.(s): AD-A517950; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517950

Much of today's innovation in warfare involves space enabled technologies, such as precision weapons using global positioning system information, missile defense systems designed to engage enemy missiles in the lowest regions of outer space, and information operations utilizing orbiting satellites. Indeed, space-enabled technologies play a pivotal role within U.S. national security strategy, which has led some to conclude that the USA is more dependent on space than any other nation. As executive agent for space issues within the Department of Defense, the U.S. Air Force is responsible for overseeing military space operations and requirements. Choosing the Air Force for this role seems reasonable; for decades, space systems have been declared high-flying air forces. Unfortunately, many professionals within the Navy, Marine Corps, and Coast Guard have long assumed that the sea Services have little to contribute regarding the formulation of space strategy. Yet nothing could be

further from the truth. The sea Services already support the warfighter through space-enabled technologies.
DTIC
Aerospace Systems; Military Operations; Seas; Security; Space Missions

20100018883 Air Force Space Command, Peterson AFB, CO USA
2009-2010 Air Force Space Command
Kehler, C R; Nov 2009; 13 pp.; In English
Report No.(s): AD-A518310; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Air Force Space Command (AFSPC) is at a unique point in its history. AFSPC is providing military-focused space capabilities with a global perspective to the Joint warfighting team, while taking the USAF lead role in developing cyberspace capabilities, and establishing a new operational cyberspace Numbered Air Force (NAF). Additionally, AFSPC is restoring credibility and confidence in the US nuclear ICBM deterrent force while preparing to move the force to Air Force Global Strike Command (AFGSC). Each of these is being accomplished, all the while maintaining a razor-sharp focus on the operational commitments of today. Air, space and cyberspace are inextricably connected and exponentially increase each other's capabilities. They are each a critical part of today's battle and together they will form the future of the US military advantage over adversaries. Make no mistake; as with air, land and sea, space and cyberspace are now important and contested operational domains. The loss of control in any area could lead to loss of control in all areas. AFSPC is taking decisive steps to position resources and people to meet the challenges that America will encounter in the vital domains of space and cyberspace. Each member of AFSPC shares the privilege of serving the nation and its Air Force. AFSPC provides the most capable and remarkable military space, missile, and cyberspace force the world has ever known, and the challenge is to ensure those who follow can say this as well. Consistent leadership and commitment will realize this goal.
DTIC
Aerospace Systems; Military Operations

20100019031 National Defense Univ., Washington, DC USA
Spacepower in the 21st Century
Lutes, Charles D; Jan 2008; 8 pp.; In English
Report No.(s): AD-A518749; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is appropriate that during the 50th anniversary year of the dawn of spacepower, the National Defense University completed its 18-month study investigating the phenomenon of spacepower and laying the foundations for an empirical theory of it. This article provides a glimpse of the emerging themes of spacepower theory as elucidated by this study, especially as they relate to issues of national security.
DTIC
Aerospace Engineering; Aerospace Systems; Security; Warfare

20100019302 Army Space and Missile Defense Command, Huntsville, AL USA
50 Years in Space
Campbell, Kevin T.; January 2008; 7 pp.; In English
Report No.(s): AD-A517783; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517783

During the past 50 years, America has experienced all of man's triumphs and tragedies in Space. Some of you may remember December 1958, when President Dwight D. Eisenhower sent his Christmas greeting to the world from the Army's Project SCORE (Signal Communication by Orbiting Relay Equipment); the world's first communications satellite. Many of you may also remember when Americans were extremely anxious after a Soviet astronaut named Yuri Gagarin became the first man in Space on April 12, 1961, and intensely proud when 23 days later, Commander Alan Shepard became the first American in Space; placed there, by the way, on an Army Redstone developed rocket Our nation experienced great sorrow, when America suffered her first Space casualties on Jan. 27, 1967. That is when Astronauts Gus Grissom, Ed White and Roger Chaffee tragically lost their lives after a flash fire broke out in the first Apollo Command Module during a launch pad test at Launch Complex 34. Their deaths led to a redesign of the Apollo Capsule, and the successful completion of a program that safely landed the first men on the moon. There were to be many more triumphs and failures during the decades of Space exploration leading up to today. Some would remind us just how very dangerous Space travel can be, and others would forever change our view of the world and how we interact on a global scale. Space is the reason we now have instantaneous global communications as well as the ability to carry out rapid, global, financial transactions. Because of Space, we can easily

navigate to any given point on the earth and we can obtain high resolution maps of our destination when we want them. Weather forecasts identify and track major weather events. From the perspective of the USA Army, Space exploration and commercialization has profoundly impacted day-to-day combat operations and has totally changed the face of modern warfare.
DTIC
Space Exploration; Launching; Communication Satellites; Space Flight

20100019393 Lawrence Livermore National Lab., Livermore, CA USA
Solar Power Beaming: From Space to Earth
Rubenchik, Alexander M.; Parker, John M.; Beach, Raymond J.; Yamamoto, Robert M.; Apr. 14, 2009; 16 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Report No.(s): DE2010-952766; LLNL-TR-412782; No Copyright; Avail.: National Technical Information Service (NTIS)

Harvesting solar energy in space and power beaming the collected energy to a receiver station on Earth is a very attractive way to help solve mankind's current energy and environmental problems. However, the colossal and expensive 'first step' required in achieving this goal has to-date stifled its initiation. In this paper, we will demonstrate that recent advances in laser and optical technology now make it possible to deploy a space-based system capable of delivering 1 MW of energy to a terrestrial receiver station, via a single unmanned commercial launch into Low Earth Orbit (LEO).
NTIS
Lasers; Power Beaming; Solar Energy

20100020042 Air Force Space Operations (14th) 33rd Wing, Vandenberg AFB, CA USA
Space Operations
Shelton, William L; Jan 2007; 3 pp.; In English
Report No.(s): AD-A519826; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The commander, U.S. Strategic Command (USSTRATCOM), established the Joint Functional Component Command for Space (JFCC SPACE) to optimize planning, execution, and force management of Department of Defense space operations. The commander, 14th Air Force, was designated as the commander, JFCC SPACE, to conduct space operations, exercise operational control of designated space and missile warning forces on behalf of the USSTRATCOM commander, and act as the Global Space Coordinating Authority. As coordinating authority, the commander of JFCC SPACE ensures unity of effort by developing, coordinating, and conducting operational-level space campaign planning and strategy development in support of U.S. Strategic Command and other combatant commands. Through the planning and execution of space control, support, and force enhancement operations, the JFCC SPACE commander produces effects for combatant commanders, such as providing positioning, navigation, and timing for military and civil use; providing communications to remote locations beyond the line of sight of terrestrial communication systems; and supporting battlespace awareness and characterization through space systems. The desired JFCC SPACE end state is unity of command and effort in the unimpeded delivery of full-spectrum joint space effects to supported commanders and the ability to deny the benefits of the space medium to adversaries for purposes hostile to the USA. In order to reach this desired end state, the USA must have robust, efficient, and effective space-based capabilities. Also, our operations centers (the Joint Space Operations Center and the Air Operations Centers) must work closely together to deliver the space effects that combatant commanders demand.
DTIC
Aerospace Systems; Command and Control; Military Operations; Space Missions

20100020241 NASA, Washington, DC, USA
Aerospace Safety Advisory Panel Annual Report for 2009
January 2010; 117 pp.; In English; Original contains color and black and white illustrations
Report No.(s): PB2010-104342; No Copyright; Avail.: CASI: A06, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020241

Since establishment by Congress in 1968, after the Apollo 1 spacecraft fire, the ASAP (the Panel) has been operating under a broad charter (Attachment 1 on the enclosed CD) to provide advice and make recommendations to the NASA Administrator on matters related to safety. In 2005, the ASAP Charter was expanded to include advising the Administrator and Congress with respect to hazards to the adequacy of proposed or existing safety standards, and with respect to management and culture related to safety. Additionally, after the Columbia accident, Congress required that the ASAP submit an annual report to Congress as well as the NASA Administrator documenting the Panels observations and recommendations. This year, the Panel has advised NASA on issues that have significant potential to directly or indirectly impact the safety of NASAs

astronauts, personnel, contractors, programs, and missions. The Panel recommendations submitted to the Administrator during 2009 are summarized in Appendix 1 at the end of this report (and detailed in Attachment 2 on the enclosed CD). They are based on ASAP 2009 quarterly meetings, public session minutes, and fact-finding meetings (all documented in Attachments 3 and 4 on the enclosed CD), as well as direct observations of NASA operations and decision-making and the Panel members past experiences.
Author
Aerospace Safety; Aerospace Systems; Safety

13
ASTRODYNAMICS

Includes powered and free flight trajectories; orbital and launching dynamics.

20100018707 Naval Postgraduate School, Monterey, CA USA
Development of a Payload Derived Position Acquisition System for Parachute Recovery Systems
Tiaden, Ryan D; Yakimenko, Oleg A; Aug 2008; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517937; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517937

For parachute recovery systems (PRS) there is a requirement, for testing and operational use, to know the entire trajectory of the PRS. For testing, the trajectory is required to understand the opening characteristics and the flight performance of the PRS. For operational use, the trajectory information is utilized in real-time for the guidance and control of precision systems. Currently, there are certain limitations in how these trajectories are generated. The paper advocates the development of a Payload Derived Position Acquisition System (PDPAS) to overcome these problems. The PDPAS is an instrumentation set and software algorithm that is to be installed onto PRS in order to estimate PRS state vector parameters in real-time for testing and operational use. Ideally it needs to be done without continuous use of the Differential Global Positioning System receiver and should produce a six degree-of-freedom solution for the PRS's trajectory from aircraft exit to ground impact. The paper discusses the details of developed algorithms, results of computer simulations and processing of real drop data.
DTIC
Parachutes; Payloads; Trajectories

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20100018815 Naval Research Lab., Washington, DC USA
On-Orbit Microwave Curing of Space Shuttle Repair Materials
Fliflet, A W; Lombardi, M T; Gold, S H; Lewis III, D; Bruce, R W; Kinkead, A K; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518213; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518213

The loss on re-entry of the space shuttle Columbia on February 1, 2003, from launch damage to the reinforced carbon composite (RCC) wing leading edge has led NASA to require capabilities for shuttle on-orbit inspection and repair. NRL's Beam Physics Branch became involved with efforts to develop repair technologies for RCC materials through their expertise in microwave materials processing and microwave systems design and fabrication. Microwave sources are well suited for curing repair materials in the space environment because of their high electrical efficiency and ability to couple energy into repair materials volumetrically to provide rapid, localized heating. Alternative methods (heat lamp or a conductive heating blanket) were unsuitable because of inefficient surface heating with the heat lamp or difficulty in positioning the blanket in microgravity to obtain proper heating of the repair area without damaging the repair surface. The NRL team's investigation of onorbit microwave curing of shuttle repair materials was carried out in collaboration with scientists at NASA Marshall

Space Flight Center (MSFC), Huntsville, AL, and astronaut James F. Reilly II.
DTIC
Aerospace Environments; Carbon; Carbon Fibers; Curing; Fiber Composites; Maintenance; Microwave Equipment; Microwaves; Space Shuttles

20100020186 NASA Marshall Space Flight Center, Huntsville, AL, USA
Tight Fits for Americas Next Moon Rocket, Ares V
Jaap, John; Fisher, Wyatt; Richardson, Lea; April 25, 2010; 1 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA
Report No.(s): M09-0619; Copyright; Avail.: Other Sources; Abstract Only

America has begun the development of a new heavy lift rocket which will enable humans to return to the moon and reach even farther destinations. Five decades ago, the National Aeronautics and Space Administration designed a system (called Saturn/Apollo) to carry men to the moon and back; the rocket which boosted them to the moon was the Saturn V. Saturn V was huge relative to contemporary rockets and is still the largest rocket ever launched. The new moon rocket is called Ares V. It will insert 40% more payload into low earth orbit than Saturn V; and after docking with the crew spacecraft, it will insert 50% more payload onto the translunar trajectory than Saturn V. The current design of Ares V calls for two liquid-fueled stages and 2 'strap-on' solid rockets. The solid rockets are extended-length versions of the solid rockets used on the Shuttle. The diameter of the liquid stages is at least as large as the first stage of the Saturn V; the height of the lower liquid stage (called the core stage) is longer than the external tank of the Shuttle. Huge rockets require huge infrastructure and, during the Saturn/Apollo era, America invested significantly in manufacturing, assembly and launch facilities which are still in use today. Since the Saturn/Apollo era, America has invested in additional infrastructure for the Shuttle program. Ares V must utilize this existing infrastructure, with reasonable modifications. Building a rocket with 50% more capability in the same buildings, testing it in the same test stands, shipping on the same canals under the same bridges, assembling it in the same building, rolling it to the pad on the same crawler, and launching it from the same launch pad is an engineering and logistics challenge which goes hand-in-hand with designing the structure, tanks, turbines, engines, software, etc. necessary to carry such a large payload to earth orbit and to the moon. This paper quantitatively discusses the significant 'tight fits' that are constraining Ares V. The engineers designing and building the infrastructure for the Saturn/Apollo program usually added margins and growth capability; sometimes the size of existing facilities (such as the width of a draw bridge) was not a constraint. Ares V may utilize the 'extra' space in the existing facilities and expand other tight fits. Some of the tight fits cannot be overcome without great expense; raising the roof on the Vertical Assembly Building for example. Other tight fits are easily overcome; the transporter at the manufacturing facility for the core stage can pass under low ceilings and later over a dike (without dragging the middle) by retracting or extending the struts which support the stage. Tight fits discussed in this paper include manufacturing (jigs, widths, heights, and local transportation), testing (test stand sizes and crane capability), transportation to the test stands and the launch site (barge, waterway, and rail), assembly (VAB internal dimensions and door size), roll-out limits, and launch pad size.
Author
Ares 5 Cargo Launch Vehicle; Low Earth Orbits; Launching; External Tanks; Payloads; Saturn 5 Launch Vehicles; Launching Bases

20100020194 NASA Marshall Space Flight Center, Huntsville, AL, USA
Voice Over Internet Protocol (VoIP) in a Control Center Environment
Calvelage, Steven; Fooshee, Doug; Pirani. Joseph; April 25, 2010; 1 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA
Report No.(s): M09-0718; Copyright; Avail.: Other Sources; Abstract Only

The technology of transmitting voice over data networks has been available for over 10 years. Mass market VoIP services for consumers to make and receive standard telephone calls over broadband Internet networks have grown in the last 5 years. While operational costs are less with VoIP implementations as opposed to time division multiplexing (TDM) based voice switches, is it still advantageous to convert a mission control center s voice system to this newer technology? Marshall Space Flight Center (MSFC) Huntsville Operations Support Center (HOSC) has converted its mission voice services to a commercial product that utilizes VoIP technology. Results from this testing, design, and installation have shown unique considerations that must be addressed before user operations. There are many factors to consider for a control center voice design. Technology advantages and disadvantages were investigated as they refer to cost. There were integration concerns which could lead to complex failure scenarios but simpler integration for the mission infrastructure. MSFC HOSC will benefit from this voice

conversion with less product replacement cost, less operations cost and a more integrated mission services environment. Author

Broadband; Time Division Multiplexing; Protocol (Computers); Internets; Telephones

20100020218 NASA Marshall Space Flight Center, Huntsville, AL, USA

Developing a Logistics Data Process for Support Equipment for NASA Ground Operations

Chakrabarti, Suman; April 25, 2010; 1 pp.; In English; SpaceOps 2010: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Report No.(s): M09-0653; No Copyright; Avail.: Other Sources; Abstract Only

The USA NASA Space Shuttle has long been considered an extremely capable yet relatively expensive rocket. A great part of the roughly US $500 million per launch expense was the support footprint: refurbishment and maintenance of the space shuttle system, together with the long list of resources required to support it, including personnel, tools, facilities, transport and support equipment. NASA determined to make its next rocket system with a smaller logistics footprint, and thereby more cost-effective and quicker turnaround. The logical solution was to adopt a standard Logistics Support Analysis (LSA) process based on GEIA-STD-0007 http://www.logisticsengineers.org/may09pres/GEIASTD0007DEXShortIntro.pdf which is the successor of MIL-STD-1388-2B widely used by U.S., NATO, and other world military services and industries. This approach is unprecedented at NASA: it is the first time a major program of programs, Project Constellation, is factoring logistics and supportability into design at many levels. This paper will focus on one of those levels NASA ground support equipment for the next generation of NASA rockets and on building a Logistics Support Analysis Record (LSAR) for developing and documenting a support solution and inventory of resources for. This LSAR is actually a standards-based database, containing analyses of the time and tools, personnel, facilities and support equipment required to assemble and integrate the stages and umbilicals of a rocket. This paper will cover building this database from scratch: including creating and importing a hierarchical bill of materials (BOM) from legacy data; identifying line-replaceable units (LRUs) of a given piece of equipment; analyzing reliability and maintainability of said LRUs; and therefore making an assessment back to design whether the support solution for a piece of equipment is too much work, i.e., too resource-intensive. If one must replace or inspect an LRU too much, perhaps a modification of the design of the equipment can make such operational effort unnecessary. Finally, this paper addresses processes of tying resources to a timeline of tasks performed in ground operations: this enables various overarching analyses, e.g., a summarization of all resources used for a given piece of equipment. Quality Control of data will also be discussed: importing and exporting data from product teams, including spreadsheets-todatabase or data exchange between databases.

Author

Logistics Management; Data Processing; NASA Programs; Ground Support Equipment

20100020234 NASA Marshall Space Flight Center, Huntsville, AL, USA

Operating and Managing a Backup Control Center

Marsh, Angela L.; Pirani, Joseph L.; Bornas, Nicholas; April 24, 2010; 9 pp.; In English; SpaceOps 2010: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA; Original contains color illustrations

Report No.(s): M09-0717; M10-0347; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100020234

Due to the criticality of continuous mission operations, some control centers must plan for alternate locations in the event an emergency shuts down the primary control center. Johnson Space Center (JSC) in Houston, Texas is the Mission Control Center (MCC) for the International Space Station (ISS). Due to Houston s proximity to the Gulf of Mexico, JSC is prone to threats from hurricanes which could cause flooding, wind damage, and electrical outages to the buildings supporting the MCC. Marshall Space Flight Center (MSFC) has the capability to be the Backup Control Center for the ISS if the situation is needed. While the MSFC Huntsville Operations Support Center (HOSC) does house the BCC, the prime customer and operator of the ISS is still the JSC flight operations team. To satisfy the customer and maintain continuous mission operations, the BCC has critical infrastructure that hosts ISS ground systems and flight operations equipment that mirrors the prime mission control facility. However, a complete duplicate of Mission Control Center in another remote location is very expensive to recreate. The HOSC has infrastructure and services that MCC utilized for its backup control center to reduce the costs of a somewhat redundant service. While labor talents are equivalent, experiences are not. Certain operations are maintained in a redundant mode, while others are simply maintained as single string with adequate sparing levels of equipment. Personnel at the BCC facility must be trained and certified to an adequate level on primary MCC systems. Negotiations with the customer were done to match requirements with existing capabilities, and to prioritize resources for appropriate level of service. Because some of these systems are shared, an activation of the backup control center will cause a suspension of scheduled HOSC activities that

may share resources needed by the BCC. For example, the MCC is monitoring a hurricane in the Gulf of Mexico. As the threat to MCC increases, HOSC must begin a phased activation of the BCC, while working resource conflicts with normal HOSC activities. In a long duration outage to the MCC, this could cause serious impacts to the BCC host facility s primary mission support activities. This management of a BCC is worked based on customer expectations and negotiations done before emergencies occur. I.
Author
Ground Based Control; Ground Operational Support System; Integrated Mission Control Center; International Space Station; Emergencies; Flight Operations

15
LAUNCH VEHICLES AND LAUNCH OPERATIONS

Includes all classes of launch vehicles, launch/space vehicle systems, and boosters; and launch operations. For related information see also *18 Spacecraft Design, Testing and Performance*; and *20 Spacecraft Propulsion and Power*.

20100018390 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Mission Analysis and Design for Space Based Inter-Satellite Laser Power Beaming
Keller, Nicholas M.; Mar 2010; 119 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517599; AFIT/GA/ENY/10-M05; No Copyright; Avail.: CASI: A06, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018390

This research effort develops an interdisciplinary design tool to optimize an orbit for the purpose of wirelessly beaming power from the International Space Station's (ISS) Japanese Experimental Module Exposed Facility (JEM/EF) to a target satellite. For the purpose of this initiative, the target satellite will be referred to as FalconSAT6, a reference to the proposed follow-on satellite to the U.S. Air Force Academy's (USAFA) FalconSAT5 program. The USAFA FalconSAT program provides cadets an opportunity to design, analyze, build, test and operate small satellites to conduct Department of Defense (DoD) space missions. The tool developed for this research is designed to find an optimal solution balancing the need to maximize the amount of access time between the ISS and FalconSAT6 while minimizing the range between the spacecraft. This tool places mathematical rigor to the problem and determines realistic solutions using current technology. Using this tool allows mission planners to economically and accurately predict the outcome of a proposed wireless power beaming mission.
Author
Eccentricity; International Space Station; Laser Power Beaming; Mission Planning; Satellite Instruments; Space Missions; Space Stations

20100018598 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Prototype Development and Dynamic Characterization of Deployable CubeSat Booms
Thomas, Grant M; Mar 2010; 176 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517408; AFIT/GA/ENY/10-M10; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517408

The current barrier to CubeSat proliferation is their lack of utility depth. These small satellites are exceptionally well suited for specific space missions such as space weather observation and other scientific data gathering exploits, however, they are not suited for every mission. The 10cm-cube form factor that gives the CubeSat its unique advantage is also its greatest hindrance. A potential bridge over this gap is the successful integration of deployable booms onto the CubeSat structure. With this research, the Air Force Institute of Technology (AFIT) explored the parameters of deployable tapespring booms using the triangular retractable and collapsible (TRAC) cross-sectional geometry developed by Air Force Research Labs (AFRL) and used on NASA's CubeSat, Nanosail-D These booms were augmented with reflective membranes and specifically designed to deploy on orbit for the purpose of ground observation, observations that could later be used to determine the deployed dynamics of the booms from optical data gained passively by solar illumination.
DTIC
Artificial Satellites; Prototypes

20100018699 Army Space and Missile Defense Command, Huntsville, AL USA
Realities of Space Age & the Realities of Carl von Clausewitz's Theories of Fog and Friction
Pitt, Roger S; Jan 2008; 7 pp.; In English
Report No.(s): AD-A517915; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517915

The advent of Space force enhancement capabilities, as applied directly to improving the effectiveness of forces across

the full spectrum of operations by providing worldwide operational assistance to combat elements, potentially reduces the effects of Carl von Clausewitz's famous fog and friction of war. The Space assets utilized in Space force enhancement can be critical combat multipliers by providing combatant commanders with real time information that greatly enhances situational awareness and decision- making. But a cautionary note accompanies these technological advances. Satellite technologies provide a commander with a wealth of data, which, if not properly synthesized, have the potential to overwhelm. Thus, modern fog and friction can be caused by having to decipher too much information, just as it arises when leaders possess too little data to make measured decisions. Carl von Clausewitz (1780-1831) described the essence of war in his famous work, On War: EVERYTHING IN WAR IS VERY SIMPLE, BUT the SIMPLEST THING IS DIFFICULT. the DIFFICULTIES ACCUMULATE and END BY PRODUCING A KIND of FRICTION THAT IS INCONCEIVABLE UNLESS ONE HAS EXPERIENCED WAR . . . FOG CAN PREVENT the ENEMY FROM BEING SEEN IN TIME, A GUN FROM FIRING WHEN IT SHOULD, A REPORT FROM REACHING the COMMANDING OFFICER. There have been many theorists over the years who have analyzed Clausewitz's theories on friction; some speculated that as the technology revolution came to fruition the friction of war would diminish. It is generally believed that the onset of the digital age, and the additional information available to commanders, would greatly reduce the fog and friction of war to virtually nothing. Technological advancements, however, have only improved the access to data and increased the amount of data collected. Technological advancements have not been able to automatically synthesize the collected data into useful intelligible knowledge that aids in a leader's decision.
DTIC
Aerospace Engineering; Command and Control; Fog; Friction; Warfare

20100018701 Bureau International des Poids et Mesures, Sevres, France
Detection of Outliers in TWSTFT Data Used in TAI
Harmegnies, A; Panfilo, G; Arias, E F; Nov 2009; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517919; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517919

This paper describes a new filtering technique used to detect and eliminate outlying data in two-way satellite time and frequency transfer (TWSTFT) time links. In the case of TWSTFT data used to calculate International Atomic Time (TAI), three main problems have to be considered: 1. the difficulty of recognizing outliers from useful data; 2. the need to avoid deleting useful data; 3. that TWSTFT links can show an underlying slope which renders the standard treatment more difficult. Using phase and frequency filtering techniques, a new way of detecting outliers, while avoiding detection of useful data, has been developed and implemented at the BIPM to clean TWSTFT data.
DTIC
Detection; Frequencies

20100018705 Army Space and Missile Defense Command, Huntsville, AL USA
Mitigating a Threat. Pentagon Announces Plans to Shoot Down Falling Spy Satellite
Jan 2008; 9 pp.; In English
Report No.(s): AD-A517935; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517935

On Feb. 14, 2008, Deputy National Security Advisor James Jeffrey, Vice Chairman, Joint Chiefs of Staff Gen James Cartwright and NASA Administrator Michael Griffin spoke at a press briefing regarding the U. S. decision to shoot down a falling U. S. spy satellite. This article includes a portion of the transcript from that briefing. The briefing in its entirety can be found at http://www.defenselink.mil/transcripts/transcript.aspx?transcriptid=4145.
DTIC
Military Operations; Missiles; Planning; Reconnaissance

20100018717 National Defense Univ., Washington, DC USA
The Global Positioning System: A Case Study in the Challenges of Transformation
Skeen, Matthew E; Jan 2008; 7 pp.; In English
Report No.(s): AD-A517963; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517963

GPS technology is equally pervasive within the military, where it creates efficiencies and enhances tactics, techniques, and procedures (TTPs) in every warfighting domain. Indeed, the merits of GPS seem obvious, but they were not so clear at many

key decision points in the program. In fact, the 48-year history of satellite navigation provides an excellent case study in the challenges associated with Department of Defense (DOD) transformation. This essay focuses on four specific periods in GPS history that provide clear lessons for those individuals leading transformation. In the first two periods, the contrast between the strong leadership that spurred the decision to formally start the GPS program and the lackluster leadership that later encouraged a congressional committee to recommend terminating it demonstrates the essential importance of visionary leadership in the higher levels of DOD. Next, an examination of an operational success and a missed opportunity in Operation Desert Storm highlights the benefit of harnessing the creativity of our Soldiers, Sailors, Marines, and Airmen in the field to accelerate transformation. Finally, a brief consideration of GPS today provides a clear reminder that effective transformation does not shift our forces from one technology to another, but rather creates an organization that is able to stay ahead of adversaries who use the tools of our globalized world to counter our strengths.
DTIC
Global Positioning System; Leadership; Navigation; Positioning

20100018727 Naval Research Lab., Washington, DC USA
First-Principles Simulations of Violent Space-Weather Events
DeVore, C R; Antiochos, S K; Jan 2008; 10 pp.; In English
Report No.(s): AD-A517985; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517985

We have developed a first-principles model for simulating the initiation and propagation of magnetic eruptions originating in the Sun's atmosphere. The ejecta from these violent events adversely affect military and civilian facilities and operations on Earth. Energetic particles and radiation also pose prompt, direct hazards to technological systems and humans in space. Recently we have demonstrated that slow, coherent motions across the solar surface can energize susceptible magnetic field configurations and power subsequent catastrophic eruptions. The velocities and energies of our simulated events compare favorably with those observed, as do their morphological magnetic-field and plasma signatures. Our results also exhibit homology (repeated similar events originating from a single source), prompt reformation of the source region in the low solar atmosphere, and a magnetic-bottle configuration of the ejected field in the interplanetary medium. A fundamental understanding of these phenomena is a prerequisite for future physics-based forecasting of space weather.
DTIC
Aerospace Environments; Computerized Simulation; Disasters; Energetic Particles; Forecasting; Interplanetary Space; Simulation; Space Weather; Weather

20100018756 Istituto Nazionale di Ricerca Metrologica, Turin, Italy
Evaluation of the Time and Frequency Transfer Capabilities of a Network of GNSS Receivers Located in Timing Laboratories
Piriz, Ricardo; Cerretto, Giancarlo; Perucca, Andrea; Tavella, Patrizia; Nov 2009; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518052; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518052

In this paper, we investigate a possible network solution, similar to the IGS Analysis Center solutions, that can be easily managed by a network of timing institutes to solve for all the clock differences (in addition to other quantities) in a unique system to understand the feasibility and the advantages of this approach in time and frequency transfer. The investigation is based on a tool called magicGNSS, which is a Web application for GNSS data processing developed by GMV in Madrid, Spain. magicGNSS allows the users to perform a wide range of calculations and analyses related to GNSS, from the evaluation of performances at user level, to the computation of precise GNSS orbits and clocks, including the calculation of precise receiver coordinates. The time and frequency transfer capabilities of the network solution (named ODTS) are evaluated and compared to PPP solutions as well as to other time transfer results. The possibility to use magicGNSS as an almost near-real-time tool for the comparison of atomic clocks and time scales located in timing laboratories is also addressed.
DTIC
Frequencies; Receivers; User Requirements

20100018762 Naval Research Lab., Washington, DC USA

GPS Block IIF Rubidium Frequency Standard Life Test

Vannicola, F; Beard, R; White, J; Senior, K; Kubik, T; Wilson, D; Buisson, J; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518066; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518066

Since August 2008, two production PerkinElmer Rubidium Frequency Standards (RFS) built for the GPS Block IIF satellites have been under test at the Naval Research Laboratory (NRL) Precision Clock Evaluation Facility (PCEF). NRL, in conjunction with the GPS Wing, GPS Block IIF prime contractor Boeing, and the RFS manufacturer PerkinElmer, is conducting a minimum 3-year life test on the GPS IIF RFS units, serial numbers 5 and 25. The primary objectives of the program will be the verification of the design's life and reliability. A secondary objective will be the long-term characterization and evaluation of the GPS IIF RFS performance parameters. The two units are being operated in independent thermal vacuum chambers with high-resolution monitoring of the clock's frequency compared to the NRL hydrogen maser references. The units' internal monitors that would normally be sent as telemetry and environmental test conditions are monitored and recorded with high resolution. A status will be presented of the GPS IIF RFS units under test.

DTIC

Atomic Clocks; Frequency Standards; Global Positioning System; Rubidium

20100018781 National Inst. of Information and Communications Technology, Tokyo, Japan

Time and Frequency Activities at NICT, Japan

Koyama, Yasuhiro; Imamura, Kuniyasu; Iwama, Tsukasa; Hama, Shin'ichi; Amagai, Jun; Ichikawa, Ryuichi; Hosokawa, Mizuhiko; Nov 2009; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518097; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518097

At NICT, Japan, research and developments for the time and frequency standards are performed by the Space-Time Standards Group. The objectives of this group are to establish standards and reference of space and time as the fundamental basis for various fields of activities in science, engineering, and social activities, and to provide easy access to these foundations from wide range of communities. The recent activities and achievements of the group are reported in this paper.

DTIC

Frequencies; Frequency Standards; Information Systems; Japan; Satellite Communication; Time Measurement

20100018795 National Inst. of Advanced Industrial Science and Technology, Ibaraki, Japan

Ressox Control of QZSS During Communication Interruption

Iwata, Toshiaki; Matsuzawa, Takashi; Abei, Akiyoshi; Nov 2009; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518146

The Remote Synchronization System for the Onboard Crystal Oscillator (RESSOX) is a new timekeeping method for the Japanese Quasi-Zenith Satellite System (QZSS), and a remote synchronization system for the onboard crystal oscillator of a satellite and the atomic clock of the ground station. RESSOX is developed with an eye to replacing the onboard atomic clock. One of the serious problems of RESSOX is that the QZSS must have an approximately 35-minute communication interruption twice a day to avoid interfering with the communication of other geostationary satellites when the QZS crosses the equator. During the communication interruption, the onboard crystal oscillator will be controlled, not by RESSOX, but by an onboard local system. Two control algorithms were proposed: (1) the averaging of adjacent voltage data and (2) the first-order extrapolation of adjacent voltage data prior to communication interruption. As the behavior of the crystal oscillator is statistical, we attempted to apply a statistical method using our RESSOX hardware/software simulators for the evaluation. At least 12 experiments/simulations were conducted for each case. The standard deviations of the maximum synchronization errors during the 35-minute communication interruption between the onboard crystal oscillator of the satellite and the atomic clock of the ground station were compared. The results of simulations and experiments correspond to each other. In general, the results obtained by averaging show better synchronization than those obtained by first-order extrapolation. The best result was given by the case of averaging 100 adjacent voltage data, and the standard deviation of the maximum synchronization error was 2.80 ns.

DTIC

Artificial Satellites; Crystal Oscillators; Interruption; Remote Control; Synchronism

20100018799 Industrial Coll. of the Armed Forces, Washington, DC USA

China in Space: Implications for U.S. Military Strategy

Metzler, P G; Jan 2007; 4 pp.; In English

Report No.(s): AD-A518153; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518153

China's January 11, 2007, launch of an antisatellite (ASAT) weapon against a low Earth orbit satellite heralded the end of a self-imposed 20-year period in which the USA and Russia had refrained from using destructive weapons in space. In addition to highlighting a growing capacity to limit the use of space by others, China's demonstration has generated demands for the USA to review its space policy and establish agreements to prevent the use of space for military purposes. Others have called for the opposite: a renewed space race and the deployment of space-based weapons. One thing is clear, however: China's growing space capability has profound implications for U.S. military strategy and, ultimately, national policy.

DTIC

Aerospace Engineering; Aerospace Systems; China; Military Operations; Policies; Responses; Space Law; Strategy; United States

20100018823 Naval Research Lab., Washington, DC USA

Pyroconvection and Climate Change

Fromm, M; Miller, S; Turk, J; Lee, T; Jan 2007; 3 pp.; In English

Report No.(s): AD-A518228; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518228

In March 1998, the Naval Research Laboratory (NRL) launched a satellite instrument named Polar Ozone and Aerosol Measurement (POAM) III. Just a few months after launch, POAM III started detecting mysterious clouds in the stratosphere in the sub-Arctic northern hemisphere. It was obvious that an unusual phenomenon was being recorded. We now know that these mysterious aerosol-cloud layers were smoke from forest fires that erupted like a volcano into what is now called pyrocumulonimbus (pyroCb for short). This initial discovery has been followed by more research and discovery by NRL's Remote Sensing and Marine Meteorology Divisions. In this article we summarize highlights of our pyroCb research and its importance. Until the discovery of pyroCb, the common wisdom was that there was only one natural terrestrial force that could inject material into the lower stratosphere- a volcanic eruption. Volcanic eruptions are well known and their impact on climate can be significant. The tropopause is still considered by many to be an effective lid for any force except a strong volcano. With the recent work at NRL we now have characterized the unique and formidable power of the pyroCb in action and even found a nuclear winter/volcano type link between stratospheric smoke layers and cooling near the Earth's surface.

DTIC

Aerosols; Artificial Satellites; Climate; Climate Change; Cumulonimbus Clouds; Ozone; Spectroradiometers; Tropopause

20100018891 Naval Postgraduate School, Monterey, CA USA

Spacecraft Guidance Strategies for Proximity Maneuvering and Close Approach with a Tumbling Object

Boyarko, George A; Mar 2010; 224 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A six degree of freedom, 20-state model of two spacecraft rendezvous is developed, one of which was controlled and the other considered to be passively tumbling. Solutions that minimize a series of performance indices are obtained for the problem of close approach, up to the point of contact, using a direct optimal control method. The solution is then verified as optimal by way of an indirect method based on the Minimum Principle. Next, a trajectory generation method for spacecraft reorientation is developed, based on a quaternion construction of Inverse Dynamics in the Virtual Domain. This new construction enables development of an Inverse Dynamics in the Virtual Domain rapid-trajectory generation method that exploits the concept of decoupling space and time, for the problem of a spacecraft performing a close approach maneuver to a tumbling object. Finally, the advantages of the new method are demonstrated through simulated scenarios that employ two distinct concepts of closed-loop feedback. The benefits seen by Inverse Dynamics in the Virtual Domain methods include the rapid computational time that allows a feasible solution to be generated, potentially onboard a spacecraft and in closed-loop. Although the Inverse Dynamics in the Virtual Domain method cannot match the true optimal solution, it has several advantages. Rapid computational time and the ability to reshape itself when provided updated state variable information reinforce the overall robustness of the method for safe trajectory planning. The novel trajectory generation method developed is tested using Monte Carlo methods to demonstrate its ability to handle realistic situation with varying initial conditions.

DTIC

Maneuvers; Rendezvous Spacecraft; Safety; Spacecraft Guidance; Trajectories; Tumbling Motion

20100018923 Army Space and Missile Defense Command, Huntsville, AL USA
Space Assets: Key Combat Enabler for Multinational Force West
Russell, Michael J; Jan 2007; 3 pp.; In English
Report No.(s): AD-A518446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

UFO, GPS, DSP. What do these three acronyms have in common? If you answered Space, as in the final frontier, then you're absolutely correct. Each acronym (UFO - Ultrahigh Frequency Follow-On, GPS - Global Positioning System and DSP - Defense Support Program) represents a different constellation of Department of Defense satellites; satellites that provide critical combat support to warfighters around the globe. Those Space professionals reading this will see this opening statement as a real duh kind of thing, but to a group of U.S. Marines who knew nothing about space support, they became central to acquiring support they never dreamed possible. In Iraq, Space teams are supporting the division, multinational corps, and combined air and ground component headquarters levels, all of whom are supporting the Global War on Terror.
DTIC
Aerospace Environments; Artificial Satellites; Combat; Defense Program; Global Positioning System; Spacecraft Defense; Ultrahigh Frequencies; Unidentified Flying Objects

20100018925 Army Space and Missile Defense Command, Huntsville, AL USA
Army Space and Missile Defense Command's Position on Space
O'Brien, Patrick; Jan 2007; 5 pp.; In English
Report No.(s): AD-A518448; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The JP 3-14, Joint Doctrine for Space Operations, is under periodic revision. Given the pace of operations and the very rapid evolution, development, and fielding of new Space systems over the past five years, this updated publication is likely to be profoundly changed from its current form. This new publication will greatly impact all Army Space forces until the next update scheduled for 2014. In the summer 2007, there will be a contingent designated by Department of the Army to represent our interests during the rewrite of the publication. This article describes an ongoing effort to define the Official SMDC Position on Space. When completed, this document will evolve into the Army's Position on Space and will serve as a guide to ensure that the new Joint Doctrine will support all of the services needs over the next several years. Since JP 3-14 was last published in August 2002, there have been numerous updates in Space products and equipment as well as new missions and requirements demanded of the Army Space Cadre. With that have come new Tactics Techniques and Procedures, Command and Control relationships, and other procedures developed by Army Space personnel that have yet to be fully captured and codified so that we may update Joint and Service doctrine. We at the Future Warfare Center's Directorate of Combat Development need your help in encapsulating these innovative measures that you have seen or developed to ensure that the rapidly evolving Space doctrine keeps pace with what you are doing in the field. This article is intended to provide inspiration for you to give us exactly that type of input.
DTIC
Aerospace Systems; Missile Defense; Tactics

20100018926 Army Space and Missile Defense Command, Huntsville, AL USA
The Future of Army Space Forces: A Vision to Optimize Tactical and Operational Space Support
Guerriero, Bob; James, Tom; Rozzi, Jim; Jan 2007; 13 pp.; In English
Report No.(s): AD-A518451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Space support to Land Component formations continues to evolve as the requirements for Space support change and grow. This evolution is apparent in the methods and procedures used to deliver Space support, as well as in the organizational structure that is developing and expanding to provide this support. The Army's current organizational structure for Space is largely a result of the confluence of the Global War on Terror and the effects of Army Transformation. Specifically, Army Space Support Teams and Space Support Elements have been modified in terms of both organization and function even as we work to complete the fielding of these Teams and Elements across the Modular Army. Today's structure, including both personnel and equipment, is not optimized to deliver Space support for current operations and will not be adequate in the future without additional evolution. This paper will address Land Component Space support needs, the organizations designed to deliver this support, the roles and functions of those organizations, and recommendations for optimizing the quality and effectiveness of Space support.
DTIC
Aerospace Systems; Logistics Management; Space Missions

20100018932 National Physical Lab., Teddington, UK

Preliminary Comparison of Two-Way Satellite Time and Frequency Transfer and GPS Common-View Time Transfer During the Intelsat Field Trial

Davis, J A; Lewandowski, W; DeYoung, J A; Kirchner, D; Hetzel, P; Jong, G de; SoEring, A; Baumont, F; Klepczynski, W; McKinley, A; Parker, T; Bartle, K A; Ressler, H; Robnik, R; Veenstra, L; Dec 1995; 13 pp.; In English

Report No.(s): AD-A518476; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For a decade and a half GPS Common-View time transfer has greatly served the needs of primary timing laboratories for regular intercomparisons of remote atomic clocks. However, GPS as a one-way technique has natural limits and may not meet all challenges of the comparison of the coming new generations of atomic clocks. Two-Way Satellite Time and Frequency Transfer (TWSTFT) is a promising technique which may successfully complement GPS. For two years, regular TWSTFT's have been performed between eight laboratories situated in both Europe and North America, using INTELSAT satellites. This has enabled an extensive direct comparison to be made between these two high performance time-transfer methods. The performance of the TWSTFT and GPS Common-View methods are compared over a number of time-transfer links. These links use a variety of time-transfer hardware and atomic clocks and have baselines of substantially different lengths. The relative merits of the two time-transfer systems are discussed.

DTIC

Artificial Satellites; Frequencies; Global Positioning System; INTELSAT Satellites

20100018939 NMI Van Swinden Lab., Delft, Netherlands

Results of the Calibration of the Delays of Earth Stations for TWSTFT Using the VSL Satellite Simulator Method

de Jong, Gerrit; Kirchner, Dieter; Ressler, H; Hetzel, Peter; Davis, John; Pears, Peter; Powell, Bill; McKinley, Angela D; Klepczynski, Bill; DeYoung, James; Hackman, Christine; Jefferts, Steve R; Parker, Thomas E; Dec 1995; 15 pp.; In English

Report No.(s): AD-A518490; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two-Way Satellite Time and Frequency Transfer (TWSTFT) is the most accurate and precise method of comparing two remote clocks or time scales. The accuracy obtained is dependent on the accuracy of the determination of the non-reciprocal delays of the transmit and the receive paths. When the same transonders in the satellite at the same frequencies are used, ten the non-receiprocity in the earth stations is the limiting factor for absolute time transfer.

DTIC

Artificial Satellites; Calibrating; Frequencies; Global Positioning System; Ground Stations; Simulators

20100018940 Naval Observatory, Washington, DC USA

The 1994 International Transatlantic Two-Way Satellite Time and Frequency Transfer Experiment: Preliminary Results

DeYoung, J A; Klepczynski, W J; McKinley, A D; Powell, W; Mai, P; Hetzel, P; Bauch, A; Davis, J A; Pearce, P R; Baumont, F; Claudon, P; Grudler, P; de Jong, G; Kirchner, D; Ressler, H; Soering, A; Hackman, C; Veenstra, L; Dec 1994; 12 pp.; In English

Report No.(s): AD-A518491; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The international transatlantic time and frequency transfer experiment was designed by participating laboratories and has been implemented during 1994 to test the international communications path involving a large number of transmitting stations. This paper will present empirically determined clock and time scale differences, time and frequency domain instabilities, and a representative power spectral density analysis. The experiments by the method of co-location which will allow absolute calibration of the participating laboratories have been performed. Absolute time differences and accuracy levels of this experiment will be assessed in the near future.

DTIC

Artificial Satellites; Frequencies; Telecommunication

20100018993 Naval Postgraduate School, Monterey, CA USA

Climate Analysis of Lightning Launch Commit Criteria for Kennedy Space Center and Cape Canaveral Air Force Station

Muller, Eric C; Mar 2010; 140 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518642; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have conducted climate analyses of natural lightning activity at Kennedy Space Center and Cape Canaveral Air Force Station (KSC/CCAFS). These analyses were conducted to improve forecasts of lightning related hazards for, and the planning

of, space vehicle launches at KSC/CCAFS. If a space vehicle is hit by lightning during launch, the vehicle and payload may sustain irreparable damage. Lightning-based rules for conducting launch and vehicle preparation activities have been developed by launch managers at KSC/CCAFS. In this research, we investigated one aspect of these?the natural lightning launch commit criteria. Our goal was to improve the scientific basis for skillful forecasting of the probability of lightning hazards. Such forecasts have the potential to reduce lightning related risks to personnel and equipment, and to save millions of dollars in preparation and launch costs. Using cloud-to-ground lightning strike data from the National Lightning Detection Network during January 1989 through December 2008, we identified events in which the KSC/CCAFS natural lightning criteria for launches were violated that is, when excessive lightning activity prevented or would have prevented launches from occurring. Based on these events, we developed daily and multi-day probabilities of lightning violations. We also developed and applied an objective statistical method for determining the seasonality of lightning and for identifying six lightning violation seasons through the course of the calendar year. These seasons were used as the basis for characterizing the temporal and spatial patterns associated with climate scale variations in lightning at KSC/CCAFS. We used atmospheric reanalysis data to analyze the physical processes that lead to interannual variability in: (a) lightning violations in each season; and (b) the start and end dates of the main lightning season.
DTIC
Cape Kennedy Launch Complex; Climate; Forecasting; Launching; Lightning

20100019041 Bureau International des Poids et Mesures, Sevres, France
Anticipated Uncertainty Budgets of Praretime and T2L2 Techniques as Applied to Extras
Thomas, C; Wolf, P; Uhrich, P; Schaefer, W; Nau, H; Veillet, C; Dec 1994; 14 pp.; In English
Report No.(s): AD-A518806; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Experiment on Timing Ranging and Atmospheric Soundings, ExTRAS, was conceived jointly by the European Space Agency, ESA, and the Russian Space Agency, RSA. It is also designated the 'Hydrogen-maser in Space/Meteor-3M project'. The launch of the satellite is scheduled for early 1997. The package, to be flown on board a Russian meteorological satellite includes ultra-stable frequency and time sources, namely two active and auto-tuned hydrogen masers. Communication between the on-board hydrogen masers and the ground station clocks is effected by means of a microwave link using the modified version for time transfer of the Precise Range And Range-rate Equipment, PRARETIME, technique, and an optical link which uses the Time Transfer by Laser Link, T2L2, method. Both the PRARETIME and T2L2 techniques operate in a two-directional mode, which makes it possible to carry out accurate transmissions without precise knowledge of the satellite and station positions. Due to the exceptional quality of the on-board clocks and to the high performance of the communication techniques with the satellite, satellite clock monitoring and ground clocks synchronization are anticipated to be performed with uncertainties below 0.5 ns (1 sigma). Uncertainty budgets and related comments are presented.
DTIC
Artificial Satellites; Clocks; Hydrogen; Masers

20100019048 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wessling, Germany
Performance of Atomic Clocks Flown on the Space Shuttle Experiment NAVEX
Hammesfahr, J; Nau, H; Starker, S; Dec 1987; 13 pp.; In English
Report No.(s): AD-A518817; No Copyright; Avail.: Defense Technical Information Center (DTIC)
At the first German Spacelab Mission D1 in autumn 1985 a navigation experiment was flown for seven days on board the NASA Space Shuttle Challenger. Two atomic clocks, one Cs- and one Rb-standard, were part of the spaceborne equipment and were carried back to earth. The Cs-clock was compared with a ground based Cs-clock by a two way microwave link at 1.5 GHz in the periods of ground contact, while the comparison between the flying Cs- and Rb-clock occurred continuously. The influence of the space flight on clock rates was determined by comparison with many series of measurements on the ground before and after the D-1 Mission. Comparisons of the flight clocks at Cape Kennedy with the reference clock in Germany were performed via GPS. Results of the data evaluation will be presented with special attention to temperature effects. Unexpected rate oscillations between the two flying clocks correlated with the attitude of the space vehicle were discovered.
DTIC
Atomic Clocks; Microwaves; Space Flight; Space Shuttles; Spaceborne Experiments

20100019049 Naval Research Lab., Washington, DC USA

Interim Results from the Characterization Testing of the Engineering Development (EDM) Rubidium Clocks for Satellite Applications

Powers, Jr , Edward D; Danzy, Frederick; Dec 1990; 7 pp.; In English

Report No.(s): AD-A518819; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents some interim results from the environmental testing program to evaluate the Engineering Design Model (EDM) of the EC&G Spaceborne Rubidium Clock. This effort is in support of the GPS Block IIR program and is intended to characterize the performance of EG&G design for BLOCK IIR satellite applications. Two EG&G EDM units are currently under test at NRL's Clock Test Facility to measure the long-term frequency stability, drift, and frequency versus temperature characteristics.

DTIC

Artificial Satellites; Atomic Clocks; Clocks; Global Positioning System; Product Development; Rubidium

20100019050 International Telecommunications Satellite Organization, Washington, DC USA

International Two-Way Satellite Time Transfers Using INTELSAT Space Segment and Small Earth Stations

Veenstra, L B; Dec 1990; 18 pp.; In English

Report No.(s): AD-A518820; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The satellite system operated by the International Telecommunications Satellite Organization (INTELSAT) provides new and unique capabilities for the coordination of international time scales on a world wide basis using the two-way technique. A network of coordinated clocks using small satellite earth stations collocated with the time scales is possible. Antennas as small as 1.8 m at K-band and 3 m at C-band transmitting powers of less than 1 W will provide signals with timing jitters of less than 1 ns wing existing spread spectrum modems. One way time broadcasting is also possible, under the INTELSAT INTELNET system, possibly using existing international data distribution (press and financial) systems that are already operating spread spectrum systems. The technical details of the satellite and requirements on satellite earth stations are given. The resources required for a regular operational international time transfer service is analyzed with respect to the existing international digital service offerings of the INTELSAT Business Service (IBS) and INTELNET. Coverage areas, typical link budgets, and a summary of previous domestic and international work using this technique are provided. Administrative procedures for gaining access to the space segment are outlined. Contact information for local INTELSAT signatories is listed.

DTIC

Broadcasting; Communication Satellites; Ground Stations; INTELSAT Satellites; Space Stations

20100019652 Army Space and Missile Defense Command, Huntsville, AL USA

Asymmetrical Threats: A Vital Relevancy for Information Operations

Campbell, Kevin T; Jan 2007; 7 pp.; In English

Report No.(s): AD-A518865; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518865

The end of the Cold War resulted in significant realignments of alliances and an increase in regional instabilities. The former Soviet Union, once the predominant threat to American security, has been supplanted by rogue and failed states and nonstate networks and actors. These entities attempt to avoid confrontation with our conventional military capabilities by striking weak points in our Nation's social, economic and political structures, or by taking advantage of perceived U.S. military vulnerabilities. Adversaries increasingly respond to U.S. military dominance by pursuing indirect, unorthodox or surprising approaches, and using the capabilities of information technology, especially the Internet, as a tool of asymmetric warfare. Because of this, Information Operations has emerged as a critical component of the Army's operational readiness. Information Operations is defined as, the integrated employment of the core capabilities of electronic warfare, computer network operations, psychological operations, military deception and operations security, in concert with specified supporting and related capabilities, to influence, disrupt, corrupt or usurp adversarial human and automated decision-making while protecting our own. Space professionals, by their access to and understanding of the relationships between the core Information Operations capabilities, are particularly well qualified to support Information Operations against asymmetric threats.

DTIC

Aerospace Engineering; Asymmetry; Countermeasures; Internets; Warfare

20100019730 South Carolina Univ., Columbia, SC USA

A Low-Cost and Field Portable Electromechanical (E/M) Impedance Analyzer for Active Structural Health Monitoring

Xu, Buli; Giurgiutiu, Victor; Jan 2005; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-01-D-5801; UTC-03-S470-033-C1

Report No.(s): AD-A519067; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519067

This paper presents the implementation of a DAQ-card-based, low-cost impedance analyzer for active structural health monitoring. Two excitation signal sources for efficient and accurate measurement of electromechanical (E/M) impedance were digitally synthesized. To compare these two signal sources for impedance measurement, a simulation for measuring the impedance spectrum of a free piezoelectric wafer active sensor (PWAS) was conducted and then followed up with free PWAS impedance spectrum measurement experiments. Finally, the performance of this novel impedance analyzer was compared to that of the HP4194A impedance analyzer using PWAS to detect a disbond on an aluminum spacecraft test panel.

DTIC

Adhesive Bonding; Analyzers; Damage; Detection; Electrical Impedance; Electromechanics; Health; Impedance; Low Cost; Mechanical Impedance; Spacecraft Components

20100019731 Air Univ., Maxwell AFB, AL USA

The Weaponization of Space: It Doesn't Happen in a Vacuum

Belote, Howard D; Jan 2000; 8 pp.; In English

Report No.(s): AD-A519073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519073

Through five articles culled from 30 years of Air University Review and Airpower Journal, an as-yet-unresolved debate over the merits of weaponizing space emerges. Moving away from President Eisenhower's foundation of free space, an aerospace defense specialist during the race to the Moon advocated the deployment of advanced surveillance and tracking satellites, and implied that defensive weapons should follow. Fourteen years later, at the height of ICBM and medium-range ballistic missile escalation during the Cold War, an Air Force major cried Bear and called for the immediate and overt weaponization of space. In response to similar calls -- especially to President Reagan's SDI program -- a retired Air Force officer and think-tank leader countered that space weapons were inherently destabilizing and must be avoided at all costs. Of course, the Soviet threat went away, but the space weapons enthusiasts did not -- they prophesied doom at the hands of the Chinese unless America were to rapidly develop and deploy new space capabilities. Finally, an active duty academic brought the argument back to its starting point, pointing out the excesses of the advocates' positions and suggesting pragmatic yet nonthreatening policy choices for the future.

DTIC

Policies; Space Weapons; Vacuum; Warfare

20100019782 Air Force Space Command, Peterson AFB, CO USA

High Frontier, The Journal for Space & Missile Professionals. Volume 4, Number 2, February 2008

Feb 2008; 57 pp.; In English

Report No.(s): AD-A519232; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519232

High Frontier, Air Force Space Command's space professional journal, is published quarterly. The journal provides a scholarly forum for professionals to exchange knowledge and ideas on space-related issues throughout the space community. The journal focuses primarily on Air Force and Department of Defense space programs; however, the High Frontier staff welcomes submissions from within the space community.

DTIC

Aerospace Systems; Military Operations; Missiles

20100019787 NAVSYS Corp., Colorado Springs, CO USA

A Snapshot GPS Approach for Precise Positioning and Attitude Determination of MicroSatellites

Matthews, Ben; Feb 28, 2008; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519248; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519248

No abstract available

Attitude (Inclination); Avionics; Global Positioning System; Microsatellites; Positioning; Satellite Communication; Synchronous Satellites

20100019872 Air Force Space Command, Peterson AFB, CO USA

High Frontier - The Journal for Space and Missile Professionals. Volume 4, Number 1, November 2007

Nov 2007; 69 pp.; In English

Report No.(s): AD-A519317; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This issue of High Frontier contains the following articles: The Army's Space Cadre; Space 100 - Past, Present and Future; Taking Force Development Into Orbit...it's not about you; NSSI Chancellor End of Tour Report; In Search of a Space Culture; People - the Essential Ingredient in Mission Success; We Know Where to Look; Defining the Space Professional; Forward to the Future: a Roadmap for Air Force Space Part 2; USA Air Force Academy Physics Department and Space Activities; Naval Postgraduate School - Committed and Prepared to Support the Space Cadre; Your USA Air Force Weapons School; Sustaining Nuclear Expertise in AFSPC: A Way Ahead for ICBM Maintenance and Operations; The Dark Arts: Nuclear Education in the US Air Force; One Giant Leap for Space Intelligence Professionalism; The Space Professional Functional Authority Advisory Council; A Layman's Guide to the Space Professional Development Database System; Book Reviews.

DTIC

Aerospace Engineering; Missiles

20100019936 Royal Greenwich Observatory, Herstmonceux, UK

An Off-Air Observatory Time Service

Seabrook, Anthony R; Dec 1987; 21 pp.; In English

Report No.(s): AD-A519496; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When the decision was taken to severely reduce the funding for the Greenwich Time Service, an alternative precision time service had to be found, so that the Satellite Laser Ranger could continue to operate. There were certain constraints on the alternative such as, high precision, highly reliable, not labour intensive, physically small and inexpensive. This paper shows how this was achieved. It is considered to be a unique solution not achieved before and provides an elegant solution to an inherently complex problem. Great reliance is put upon external agencies to provide the infrastructure to maintain their equipment. Use is made of the LORAN-C chain of stations for the frequency references and the Global Positioning System satellite for the Time of Day and traceability. This is a one rack complete observatory time service and the results compare very favourably with the remaining standards on site.

DTIC

Artificial Satellites; Time Measurement

20100019998 Army Space and Missile Defense Command, Huntsville, AL USA

Life in the Joint Side of Space

Price, J D; Jan 2007; 3 pp.; In English

Report No.(s): AD-A519638; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On July 19, the commander of U.S. Strategic Command signed the implementation directive giving the commander of the Joint Functional Component Command-Space (JFCC-Space) the authority and responsibility to command and control almost all Department of Defense Space assets worldwide. This is the first time that almost all of Space was centrally controlled by one command and commander. For the past couple of years, the 14th Air Force Space and Air Operations Center has transformed into a Joint Space Operations Center. For the past year, the Joint Space Operations Center has been the operations center for the commander, Joint Space Operations (JSO). This all changed after the implementation directive as the commander, JFCC-Space assumed command and control of a majority of all the Space current operational elements from Naval Space Operations Center, Army Forces Strategic Command and Air Force Space Command. The commander JFCC-Space is the Global Space Coordinating Authority and provides Space mission expertise to plan support, integrate, assess, and synchronize efforts for U.S. Strategic Command and other combatant commanders' operational level requirements. These requirements include taking lead for Space control, Space situational awareness, Space offensive and defensive operations, Space force enhancements such as Intelligence, Surveillance and Reconnaissance; ITW/AA; environmental monitoring; Satellite Communication; Positioning, Navigation and Timing; and also in Space support (lift and satellite operations), and Space force applications. JFCC-Space is also the day-to-day manager of missile warning capability and serves as the supporting commander to JFCC-Integrated Missile Defense and JFCC-Intelligence Surveillance and Reconnaissance for management of the missile warning centers and data.

DTIC

Aerospace Systems; Antimissile Defense; Command and Control; Early Warning Systems; Military Operations

20100020018 California Univ., Santa Barbara, CA USA

Optical Moorings-of-Opportunity for Validation of Ocean Color Satellites

Kuwahara, Victor S; Chang, Grace; Zheng, Xiaobing; Dickey, Tommy D; Jiang, Songnian; Jan 2008; 14 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0028; N00014-94-1-0346

Report No.(s): AD-A519686; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Buoy-mooring platforms are advantageous for time-series validation and vicarious calibration of ocean color satellites because of their high temporal resolution and ability to perform under adverse weather conditions. Bio-optical data collected on the Bermuda Testbed Mooring (BTM) were used for comparison with satellite ocean color data in an effort to further standardize sampling and data processing methods for high quality satellite-mooring comparisons. Average percentage differences between satellite-measured and mooring-derived water leaving radiances were about 20% at the blue wavelengths, decreasing to as low as 11% in the blue-green to green wavebands. Based on a series of data processing methods and analyses, recommendations concerning rigor of quality control for collected data, optimal averaging of high frequency data, sensor self-shading wind corrections, and instrumentation placement requirements are given for the design and application of optical moorings for ocean color satellite validation. Although buoy-mooring platforms are considered to be among the very best methods to validate ocean color satellite measurements, matchup discrepancies due to water column variability and atmospheric corrections remain important issues.

DTIC

Bermuda; Buoys; Extraterrestrial Oceans; Measurement; Mooring; Water Color

20100020038 Library of Congress, Washington, DC USA

Brazil's Technology Sector

Ivey, William N; Oct 2006; 55 pp.; In English

Report No.(s): AD-A519788; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study provides a general assessment of major science and technology (S&T) developments in Brazil. The report is organized into eight sections: key findings, an introduction to the topic of S&T activities in Brazil, an overview of the Brazilian government, government S&T policy, funding for research and development (R&D), S&T priorities and the domestic and foreign participants in R&D, threats to and opportunities for pursuing S&T development, and a conclusion. Prominent Brazilian research facilities and their respective specialties are listed in an Appendix. Since 2003, the government of Brazil has provided unprecedented levels of funding for domestic R&D and established incentives to increase private-sector involvement in R&D, such as strengthening intellectual property laws and tax incentives for R&D. The government has also prioritized support and development of certain sectors, specifically nanotechnology, pharmaceuticals, semiconductors, and software. Other fields that have received significant government support are agriculture, alternative energies, and space research. Military S&T has suffered from nearly two decades of funding neglect, but Brazilian entities have produced impressive armored vehicles, aircraft, artillery, and missiles. In all of these fields, private-sector and foreign participation are low relative to that of public research entities, particularly universities, but various signs suggest this is changing. Brazil R&D appears to have substantial potential to significantly improve the country's domestic economic and social development and to increase Brazil's international economic influence, However, the pervasive lack of innovation by private entities, isolation from international markets, and other indicators suggest Brazil's increased R&D efforts may not have any significant economic or political effects outside the country's borders in the foreseeable future.

DTIC

Brazil; Federal Budgets; International Relations; Policies; Research and Development; Technologies

20100020187 NASA Marshall Space Flight Center, Huntsville, AL, USA

Contingency Operations of Americas Next Moon Rocket, Ares V

Jaap, John; Richardson, Lea; April 25, 2010; 1 pp.; In English; SpcaeOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Report No.(s): M09-0620; No Copyright; Avail.: Other Sources; Abstract Only

America has begun the development of a new space vehicle system which will enable humans to return to the moon and reach even farther destinations. The system is called Constellation: it has 2 earth-launch vehicles, Ares I and Ares V; a crew module, Orion; and a lander, Altair with descent and ascent stages. Ares V will launch an Earth Departure Stage (EDS) and Altair into low earth orbit. Ares I will launch the Orion crew module into low earth orbit where it will rendezvous and dock with the Altair and EDS 'stack'. After rendezvous, the stack will contain four complete rocket systems, each capable of independent operations. Of course this multiplicity of vehicles provides a multiplicity of opportunities for off-nominal behavior and multiple mitigation options for each. Contingency operations are complicated by the issues of crew safety and

the possibility of debris from the very large components impacting the ground. This paper examines contingency operations of the EDS in low earth orbit, during the boost to translunar orbit, and after the translunar boost. Contingency operations under these conditions have not been a consideration since the Apollo era and analysis of the possible contingencies and mitigations will take some time to evolve. Since the vehicle has not been designed, much less built, it is not possible to evaluate contingencies from a root-cause basis or from a probability basis; rather they are discussed at an effects level (such as the reaction control system is consuming propellant at a high rate). Mitigations for the contingencies are based on the severity of the off-nominal condition, the time of occurrence, recovery options, options for alternate missions, crew safety, evaluation of the condition (forensics) and future prevention. Some proposed mitigations reflect innovation in thinking and make use of the multiplicity of on-orbit resources including the crew; example: Orion could do a 'fly around' to allow the crew to determine the condition and cause of a partially separated payload shroud. Other mitigations are really alternate missions; example, an engine out on during ascent resulted in insufficient propellant for the lunar mission, but the on-orbit vehicle stack is otherwise perfect and can pursue an alternate mission, such as a high ballistic trajectory to test the high-speed atmospheric reentry of Orion. Evaluation and presentation of contingency operations at this early stage of the development of the Ares V rocket will improve the design of the vehicle and lay the groundwork for the exhaustive contingency planning which must be done after the vehicle is built as preparations for operations.

Author

Ares 5 Cargo Launch Vehicle; Atmospheric Entry; Ballistic Trajectories; Launch Vehicles; Low Earth Orbits; Payloads; Safety Factors; Spacecraft Modules; Descent; Ascent

20100020190 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Supportability Engineering Implementation Utilizing DoD Practices and Processes

Smith, David A.; Smith, John V.; April 25, 2010; 1 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-29 Apr. 2010, Huntsville, AL, USA

Report No.(s): M09-0651; Copyright; Avail.: Other Sources; Abstract Only

The Ares I design and development program made the determination early in the System Design Review Phase to utilize DoD ILS and LSA approach for supportability engineering as an integral part of the system engineering process. This paper is to provide a review of the overall approach to design Ares-I with an emphasis on a more affordable, supportable, and sustainable launch vehicle. Discussions will include the requirements development, design influence, support concept alternatives, ILS and LSA planning, Logistics support analyses/trades performed, LSA tailoring for NASA Ares Program, support system infrastructure identification, ILS Design Review documentation, Working Group coordination, and overall ILS implementation. At the outset, the Ares I Project initiated the development of the Integrated Logistics Support Plan (ILSP) and a Logistics Support Analysis process to provide a path forward for the management of the Ares-I ILS program and supportability analysis activities. The ILSP provide the initial planning and coordination between the Ares-I Project Elements and Ground Operation Project. The LSA process provided a system engineering approach in the development of the Ares-I supportability requirements; influence the design for supportability and development of alternative support concepts that satisfies the program operability requirements. The LSA planning and analysis results are documented in the Logistics Support Analysis Report. This document was required during the Ares-I System Design Review (SDR) and Preliminary Design Review (PDR) review cycles. To help coordinate the LSA process across the Ares-I project and between programs, the LSA Report is updated and released quarterly. A System Requirement Analysis was performed to determine the supportability requirements and technical performance measurements (TPMs). Two working groups were established to provide support in the management and implement the Ares-I ILS program, the Integrated Logistics Support Working Group (ILSWG) and the Logistics Support Analysis Record Working Group (LSARWG). The Ares I ILSWG is established to assess the requirements and conduct, evaluate analyses and trade studies associated with acquisition logistic and supportability processes and to resolve Ares I integrated logistics and supportability issues. It established a strategic collaborative alliance for coordination of Logistics Support Analysis activates in support of the integrated Ares I vehicle design and development of logistics support infrastructure. A Joint Ares I - Orion LSAR Working Group was established to: 1) Guide the development of Ares-I and Orion LSAR data and serve as a model for future Constellation programs, 2) Develop rules and assumptions that will apply across the Constellation program with regards to the program's LSAR development, and 3) Maintain the Constellation LSAR Style Guide.

Author

Ares 1 Launch Vehicle; Constellation Program; Systems Engineering; Project Management; Launch Vehicles; Design Analysis

20100020191 NASA Marshall Space Flight Center, Huntsville, AL, USA

Objectives and Progress on Ground Vibration Testing for the Ares Projects

Tuma, Margaret L.; Chenevert, Donald J.; April 25, 2010; 1 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Report No.(s): M09-0663; No Copyright; Avail.: Other Sources; Abstract Only

Integrated vehicle ground vibration testing (IVGVT) will be a vital component for ensuring the safety of NASA s next generation of exploration vehicles to send human beings to the Moon and beyond. A ground vibration test (GVT) measures the fundamental dynamic characteristics of launch vehicles during various phases of flight. The Ares Flight & Integrated Test Office (FITO) will be conducting the IVGVT for the Ares I crew launch vehicle at Marshall Space Flight Center (MSFC) from 2012 to 2014 using Test Stand (TS) 4550. MSFC conducted similar GVT for the Saturn V and Space Shuttle vehicles. FITO will perform the IVGVT on the Ares I crew launch vehicle, which will lift the Orion crew exploration vehicle to low Earth orbit, and the Ares V cargo launch vehicle, which can launch the lunar lander into orbit and send the combined Orion/lander vehicles toward the Moon. Ares V consists of a six-engine core stage with two solid rocket boosters and an Earth departure stage (EDS). The same engine will power the EDS and the Ares I second stage. The current plan is to test six configurations in three unique test positions inside TS 4550. Four Ares I second stage test configurations will be tested in Position 3, consisting of the Upper Stage and Orion crew module in four nominal conditions: J-2X engine ignition, post Launch Abort System (LAS) jettison, critical slosh mass, and J-2X burn-out. Position 2 consists of the entire launch stack at first stage burn-out (using empty first stage segments). Position 1 represents the entire launch stack at lift-off (using inert first stage segments). Because of long disuse, TS 4550 is being repaired and modified for reactivation to conduct the Ares I IVGVT. The Shuttle-era platforms have been removed and are being replaced with mast climbers that provide ready access to the test articles and can be moved easily to support different positions within the test stand. Two new cranes will help move test articles at the test stand and at the Redstone Arsenal rail-head where first stage segments will be received in late 2010. The electrical system for TS 4550 also will be upgraded. The Hydraulic Support Systems (HDSs) used for Saturn and Shuttle are being disassembled and evaluated for use during IVGVT. Analyses indicate that the 45-year-old HDSs can be refurbished to support the Ares I IVGT. An alternate concept for a pneumatic suspension system is also being explored. A decision on which suspension system configuration to use for IVGVT will be made in 2010.

Author

Ground Tests; Vibration Tests; Launch Vehicles; Ares 1 Launch Vehicle; Crew Exploration Vehicle; Flight Tests; Systems Engineering; Support Systems

20100020219 NASA Marshall Space Flight Center, Huntsville, AL, USA

Space Operations for a New Era of Exploration Launch Vehicles

Cook, Stephen A.; Vanhooser, Teresa; April 25, 2010; 1 pp.; In English; SpaceOps 2010: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Report No.(s): M09-0662; No Copyright; Avail.: Other Sources; Abstract Only

NASA's Constellation Program is depending on the Ares Projects to deliver the crew and cargo launch capabilities needed to send human explorers to the Moon and beyond. Ares I and V will provide the core space launch capabilities needed to continue providing crew and cargo access to the International Space Station (ISS), and to build upon the U.S. history of human space exploration. Since 2005, Ares has made substantial progress on designing, developing, and testing the Ares I crew launch vehicle and has continued its in-depth studies of the Ares V cargo launch vehicles. The combined Ares I/Ares V architecture has been designed to reduce the complexity and labor intensity of ground operations for America's next journeys beyond low-Earth orbit (LEO). A deliberate effort is being made to ensure a high level of system operability to significantly increase safety and system availability as well as reduce recurring costs for this new launch vehicle. The Ares Projects goal is to instill operability as part of the vehicles requirements development, design, and operations. This simplicity will come from using simpler, proven engine designs, as in the case of the J-2X upper stage engine and RS-68 engine; improving existing hardware, as in the case of the Shuttle-heritage 5-segment solid rocket motor; and using common propulsion and instrument unit elements between Ares I and Ares V. Furthermore, lessons learned while developing Ares I will be applied directly to Ares V operations. In 2009, the Ares Projects plan to conduct the first flight test of Ares I, designated Ares I-X. Ares I-X preparations have already prompted changes to the vehicle stacking and launch infrastructure at Kennedy Space Center (KSC), including removing Shuttle-specific fixtures from the Vehicle Assembly Building (VAB) to accommodate Ares I-style stacking operations, new firing room computers and infrastructure in the VAB Launch Control Center, and new lightning protection system towers at Launch Complex 39B to accommodate the greater height of Ares I-X. In addition to lessons learned from

the stacking of Ares I-X, the flight test itself promises to yield important data and operations lessons for assembling, launching, and flying Ares I.
Author
Ares 1 Launch Vehicle; Ares 5 Cargo Launch Vehicle; International Space Station; Launching Bases; Low Earth Orbits; Spacecraft Launching; Flight Tests; Space Exploration

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SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20100018589 NASA Johnson Space Center, Houston, TX, USA
Lunar Landing Operational Risk Model
Mattenberger, Chris; Putney, Blake; Rust, Randy; Derkowski, Brian; [2010]; 12 pp.; In English; 10th International Probabilistic Safety Assessment and Management Conference, 7-11 Jun. 2010, Seattle, WA, USA; Original contains color illustrations
Report No.(s): JSC-CN-20247; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018589

Characterizing the risk of spacecraft goes beyond simply modeling equipment reliability. Some portions of the mission require complex interactions between system elements that can lead to failure without an actual hardware fault. Landing risk is currently the least characterized aspect of the Altair lunar lander and appears to result from complex temporal interactions between pilot, sensors, surface characteristics and vehicle capabilities rather than hardware failures. The Lunar Landing Operational Risk Model (LLORM) seeks to provide rapid and flexible quantitative insight into the risks driving the landing event and to gauge sensitivities of the vehicle to changes in system configuration and mission operations. The LLORM takes a Monte Carlo based approach to estimate the operational risk of the Lunar Landing Event and calculates estimates of the risk of Loss of Mission (LOM) - Abort Required and is Successful, Loss of Crew (LOC) - Vehicle Crashes or Cannot Reach Orbit, and Success. The LLORM is meant to be used during the conceptual design phase to inform decision makers transparently of the reliability impacts of design decisions, to identify areas of the design which may require additional robustness, and to aid in the development and flow-down of requirements.
Author
Altair Lunar Lander; Risk; Lunar Landing; Systems Engineering; Reliability; Complex Systems; Monte Carlo Method

20100019171 Boeing Co., Houston, TX, USA
Protection from Induced Space Environments Effects on the International Space Station
Soares, Carlos; Mikatarian, Ron; Stegall, Courtney; Schmidl, Danny; Huang, Alvin; Olsen, Randy; Koontz, Steven; May 19, 2010; 8 pp.; In English; 4th IAASS Conference, 19-21 May 2010, Huntsville, AL, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20677; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019171

The International Space Station (ISS) is one of the largest, most complex multinational scientific projects in history and protection from induced space environments effects is critical to its long duration mission as well as to the health of the vehicle and safety of on-orbit operations. This paper discusses some of the unique challenges that were encountered during the design, assembly and operation of the ISS and how they were resolved. Examples are provided to illustrate the issues and the risk mitigation strategies that were developed to resolve these issues. Of particular importance are issues related with the interaction of multiple spacecraft as in the case of ISS and Visiting Vehicles transporting crew, hardware elements, cargo and scientific payloads. These strategies are applicable to the development of future long duration space systems, not only during design, but also during assembly and operation of these systems.
Author
International Space Station; Aerospace Environments; Risk; Safety; Aerospace Systems

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes space systems telemetry; space communications networks; astronavigation and guidance; and spacecraft radio blackout. For related information see also *04 Aircraft Communications and Navigation*; and *32 Communications and Radar*.

20100018415 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Next 25 Years of Deep Space Navigation
Martin-Mur, Tomas J.; Bhaskaran, Shyam; Cesarone, Robert J.; McElrath, Tim; February 4, 2008; 15 pp.; In English; 2008 AAS Guidance Navigation and Control Conference, 4 Feb. 2008, Breckenridge, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41531

This slide presentation reviews the missions that will be flown into deep space in the next 25 years, the navigational challenges for these missions, and the strategies that will be used to overcome these challenges. The challenges include: (1) an incresed need for autonomous navigation, (2) an increased use of in-situ and optical navigation, (3) an increased use of low-thrust propulsion, (4) an increased need for higher accuracy in guidance, navigation, and control, and an increased need for integration between flight path and attitude control. The enabling strategies that are planned for use are: (1) Advance Radio-Metric Tracking Capabilities, (2) Expand the Use of Optical Navigation, (3) Develop General-Purpose Autonomous Navigation Capabilities, (4) Improve Frequency and Timing Systems, and (5) Develop In-situ Tracking Infrastructure. Future trends that are being developed are Optical and Autonomous Navigation
CASI
Autonomous Navigation; Deep Space; Space Navigation; Spacecraft Guidance; Satellite Guidance

20100019266 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Guidance and Navigation for Rendezvous and Proximity Operations with a Non-Cooperative Spacecraft at Geosynchronous Orbit
Barbee, Brent William; Carpenter, J. Russell; Heatwole, Scott; Markley, F. Landis; Moreau, Michael; Naasz, Bo J.; VanEepoel, John; May 13, 2010; 21 pp.; In English; George H. Born Symposium, 13-14 May 2010, Boulder, CO, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019266

The feasibility and benefits of various spacecraft servicing concepts are currently being assessed, and all require that the servicer spacecraft perform rendezvous, proximity, and capture operations with the target spacecraft to be serviced. Many high-value spacecraft, which would be logical targets for servicing from an economic point of view, are located in geosynchronous orbit, a regime in which autonomous rendezvous and capture operations are not commonplace. Furthermore, existing GEO spacecraft were not designed to be serviced. Most do not have cooperative relative navigation sensors or docking features, and some servicing applications, such as de-orbiting of a non-functional spacecraft, entail rendezvous and capture with a spacecraft that may be non-functional or un-controlled. Several of these challenges have been explored via the design of a notional mission in which a nonfunctional satellite in geosynchronous orbit is captured by a servicer spacecraft and boosted into super-synchronous orbit for safe disposal. A strategy for autonomous rendezvous, proximity operations, and capture is developed, and the Orbit Determination Toolbox (ODTBX) is used to perform a relative navigation simulation to assess the feasibility of performing the rendezvous using a combination of angles-only and range measurements. Additionally, a method for designing efficient orbital rendezvous sequences for multiple target spacecraft is utilized to examine the capabilities of a servicer spacecraft to service multiple targets during the course of a single mission.
Author
Geosynchronous Orbits; Space Rendezvous; Rangefinding; Orbital Rendezvous; Navigation Instruments; Spacecraft Orbits; Satellite Orbits; Orbital Servicing; Docking

20100019303 TimeTech G.m.b.H., Stuttgart, Germany
Tracking Biases Caused by Imperfections in DLL Receivers
Hejc, Gerhard; Schaefer, Wolfgang; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517966; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517966

Delay Lock Loop (DLL) is a feedback system that is able to track the code phase of a pseudo-noise (PN) signal. Imperfections in the DLL or the RF front end may or may not lead to tracking biases, which have to be removed by a receiver-specific calibration factor. The goal of this work is to show that also imperfections (spectral asymmetry of the signal,

carrier-phase imbalance of the DLL), which do not change the code phase, can result in significant biases when both effects are combined.
DTIC
Bias; Defects; Navigation Satellites; Receivers; Signal Processing

20100019538 Centre National d'Etudes Spatiales, Toulouse, France
Time Stability and Electrical Delay Comparison of Dual-Frequency GPS Receivers
Proia, A; Cibiel, G; Yaigre, L; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518025; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518025

Some dual-frequency GPS receivers have been used for time comparisons for several years. They are now standard equipment for operational units in time laboratories. Evaluation of these receivers is necessary to ensure accuracy and long-term stability of time links used in TAI and in precise time station (PTS) dedicated to GALILEO. Currently, the most widely approach used to determine the electrical delay and the time stability of these devices is the differential method developed by the BIPM. Another solution is the calibration and the evaluation of receivers in using an artificial signal simulated by a GNSS signal simulator. This method was first defined and performed by Colorado University and put into operations by the Naval Research Laboratory (NRL). Since 2005, CNES (French Space Agency) has been developing this method with a similar approach.
DTIC
Frequencies; Global Positioning System; Radio Receivers; Receivers; Stability; Time Lag

20100019539 Naval Research Lab., Washington, DC USA
NRL Global Vessel Tracking Project (VTP)
Bielecki, D J; Jan 2008; 3 pp.; In English
Report No.(s): AD-A517992; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517992

In 2003, a call for Maritime Domain Awareness (MDA) architectures was issued by the Honorable John Young, then Assistant Secretary of the Navy for Research, Development and Acquisition (ASN RD&A). The Naval Research Laboratory's Space Systems Development Department (SSDD) responded with a global architecture and estimates of resource requirements. The response featured a layered defense approach, incorporating support from sensors, databases, and information feeds ranging from National Technical Means (NTM) to Open Source Intelligence (OSINT). Essential elements of the system were funded. A Modular Sensor System (MSS) provided protection for a port, harbor, or key infrastructure element. A highly automated virtual database and information extraction capability was provided at the GENSER level. At the NTM level, a fully automated vessel tracking system provided tracks and updates for the Atlantic Ocean.
DTIC
Aerospace Systems; Intelligence; Detectors

20100020214 Aerospace Corp., El Segundo, CA USA
Evaluation of GPS/UTC Steering Performance
Feess, W A; Holtz, H; Satin, A L; Yinger, C H; Dec 1991; 15 pp.; In English
Report No.(s): AD-A518894; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518894

The Global Positioning System (GPS) is required to maintain GPS time to UTC to an accuracy of one microsecond and broadcast to the user the offset between GPS and UTC to an accuracy of 100 nanoseconds (1 sigma). On June 25, 1990, an automatic steering algorithm was implemented to control GPS time to synchronize if with UTC. The description of the steering laws and predicted performance results were presented at the 1989 PTTI conference, while preliminary performance results were presented at the 1990 PTTI conference. The initial performance was not as predicted, resulting in an in-depth analysis of the observed performance and a more thorough sensitivity analysis. In addition, responses to anomalies were investigated. This paper will describe these analyses and results, and evaluate actual steering performance from June 1990 to November 1991. Although anomalies were observed during the initial phase of steering, recent experience is more in line with expectations.
DTIC
Broadcasting; Global Positioning System; Navigation Satellites; Steering

20100020243 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simulation Training Versus Real Time Console Training for New Flight Controllers
Heaton, Amanda; April 25, 2010; 1 pp.; In English; SpaceOps 2010: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA
Report No.(s): M09-0733; No Copyright; Avail.: Other Sources; Abstract Only

For new flight controllers, the two main learning tools are simulations and real time console performance training. These benefit the new flight controllers in different ways and could possibly be improved. Simulations: a) Allow for mistakes without serious consequences. b) Lets new flight controllers learn the working style of other new flight controllers. c) Lets new flight controllers eventually begin to feel like they have mastered the sim world, so therefore they must be competent in the real time world too. Real time: a) Shows new flight controllers some of the unique problems that develop and have to be accounted for when dealing with certain payloads or systems. b) Lets new flight controllers experience handovers - gathering information from the previous shift on what the room needs to be aware of and what still needs to be done. c) Gives new flight controllers confidence that they can succeed in the position they are training for when they can solve real anomalies. How Sims could be improved and more like real-time ops for the ISS Operations Controller position: a) Operations Change Requests to review. b) Fewer anomalies (but still more than real time for practice). c) Payload Planning Manager Handover sheet for the E-1 and E-3 reviews. d) Flight note in system with at least one comment to verify for the E-1 and E-3 reviews How the real time console performance training could be improved for the ISS Operations Controller position: a) Schedule the new flight controller to be on console for four days but with a different certified person each day. This will force them to be the source of knowledge about every OCR in progress, everything that has happened in those few days, and every activity on the timeline. Constellation program flight controllers will have to learn entirely from simulations, thereby losing some of the elements that they will need to have experience with for real time ops. It may help them to practice real time console performance training in the International Space Station or Space Shuttle to gather some general anomaly resolution and day-to-day task management skills.

Author

Real Time Operation; Flight Control; Space Shuttles; International Space Station; Constellation Program; Education; Simulation

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20100018419 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Spacecraft Design Thermal Control Subsystem
Miyake, Robert N.; January 31, 2008; 35 pp.; In English; Presentation at University of Michigan, Ann Arbor, Michigan, January 31, 2008, 31 Jan .2008, Ann Arbor, MI, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41540

The Thermal Control Subsystem engineers task is to maintain the temperature of all spacecraft components, subsystems, and the total flight system within specified limits for all flight modes from launch to end-of-mission. In some cases, specific stability and gradient temperature limits will be imposed on flight system elements. The Thermal Control Subsystem of 'normal' flight systems, the mass, power, control, and sensing systems mass and power requirements are below 10% of the total flight system resources. In general the thermal control subsystem engineer is involved in all other flight subsystem designs.

Author

Temperature Control; Control Systems Design; Detection; Spacecraft Components; Spacecraft Design

20100018423 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Simple Text File for Curing Rainbow Blindness
Krylo, Robert; Tomlin, Marilyn; Seager, Michael; February 13, 2008; 10 pp.; In English; Spacecraft Thermal Control Workshop, 13 Feb. 2008, El Segundo, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41530

This slide presentation reviews the use of a simple text file to work with large, multi-component thermal models that

present a post-processing challenge. This complexity is due to temperatures for many components, with varying requirements, need to be examined and that false color temperature maps, or rainbows, provide a qualitative assessment of results.
Derived from text
Models; Temperature Distribution; Texts; Satellite Temperature; Spacecraft Design; Satellite Instruments

20100019148 NASA Marshall Space Flight Center, Huntsville, AL, USA
Xenia Mission: Spacecraft Design Concept
Hopkins, R. C.; Johnson, C. L.; Kouveliotou, C.; Jones, D.; Baysinger, M.; Bedsole, T.; Maples, C. C.; Benfield, P. J.; Turner, M.; Capizzo, P.; Fabinski, L.; Hornsby, L.; Thompson, K.; Miernik, J. H.; Percy, T.; December 2009; 60 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TM-2009-216270; M-1272; Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019148

The proposed Xenia mission will, for the first time, chart the chemical and dynamical state of the majority of baryonic matter in the universe. using high-resolution spectroscopy, Xenia will collect essential information from major traces of the formation and evolution of structures from the early universe to the present time. The mission is based on innovative instrumental and observational approaches: observing with fast reaction gamma-ray bursts (GRBs) with a high spectral resolution. This enables the study of their (star-forming) environment from the dark to the local universe and the use of GRBs as backlight of large-scale cosmological structures, observing and surveying extended sources with high sensitivity using two wide field-of-view x-ray telescopes - one with a high angular resolution and the other with a high spectral resolution.
Author
Spacecraft Design; Baryons; X Ray Telescopes; Gamma Ray Bursts; Spectral Resolution; Angular Resolution; Field of View

20100019436 GB Technology, Inc., Houston, TX, USA
Analytic Development of a Reference Profile for the First Entry in a Skip Atmospheric Entry
Garcia-Llama, Eduardo; March 23, 2010; 12 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20274; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019436

This note shows that a feasible reference drag profile for the first entry portion of a skip entry can be generated as a polynomial expression of the velocity. The coefficients of that polynomial are found through the resolution of a system composed of m + 1 equations, where m is the degree of the drag polynomial. It has been shown that a minimum of five equations (m = 4) are required to establish the range and the initial and final conditions on velocity and flight path angle. It has been shown that at least one constraint on the trajectory can be imposed through the addition of one extra equation in the system, which must be accompanied by the increase in the degree of the drag polynomial. In order to simplify the resolution of the system of equations, the drag was considered as being a probability density function of the velocity, with the velocity as a distribution function of the drag. Combining this notion with the introduction of empirically derived constants, it has been shown that the system of equations required to generate the drag profile can be successfully reduced to a system of linear algebraic equations. For completeness, the resulting drag profiles have been flown using the feedback linearization method of differential geometric control as a guidance law with the error dynamics of a second order homogeneous equation in the form of a damped oscillator. Satisfactory results were achieved when the gains in the error dynamics were changed at a certain point along the trajectory that is dependent on the velocity and the curvature of the drag as a function of the velocity. Future work should study the capacity to update the drag profile in flight when dispersions are introduced. Also, future studies should attempt to link the first entry, as presented and controlled in this note, with a more standard control concept for the second entry, such as the Apollo entry guidance, to try to assess the overall skip entry performance. A guidance law that includes an integral feedback term, as is the case in the actual Space Shuttle entry guidance and as is proposed in Ref 29, could be tried in future studies to assess whether its use results in an improvement of the tracking performance, and to evaluate the design needs when determining the control gains.
Derived from text
Atmospheric Entry; Linear Equations; Linearization; Space Shuttle Orbiters; Control Theory; Crew Exploration Vehicle

20100019576 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sequential Probability Ratio Test for Collision Avoidance Maneuver Decisions
Carpenter, J. Russell; Markley, F. Landis; May 17, 2010; 13 pp.; In English; Kyle T. Alfriend Astrodynamics Symposium, 17-19 May 2010, Monterey, CA, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019576

When facing a conjunction between space objects, decision makers must chose whether to maneuver for collision

avoidance or not. We apply a well-known decision procedure, the sequential probability ratio test, to this problem. We propose two approaches to the problem solution, one based on a frequentist method, and the other on a Bayesian method. The frequentist method does not require any prior knowledge concerning the conjunction, while the Bayesian method assumes knowledge of prior probability densities. Our results show that both methods achieve desired missed detection rates, but the frequentist method's false alarm performance is inferior to the Bayesian method's
Author
Bayes Theorem; Collision Avoidance; Probability Theory; Decision Making; Spacecraft Maneuvers

20100020171 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
GN and C Fault Protection Fundamentals
Rasmussen, Robert D.; February 1, 2008; 19 pp.; In English; 31st Annual AAS Guidance And Control Conference, 1-6 Feb. 2008, Breckenridge, CO, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41525

This is a companion presentation for a paper by the same name for the same conference. The objective of this paper is to shed some light on the fundamentals of fault tolerant design for GN&C. The common heritage of ideas behind both faulted and normal operation is explored, as is the increasingly indistinct line between these realms in complex missions. Techniques in common practice are then evaluated in this light to suggest a better direction for future efforts.
Author
Fault Tolerance; Navigation; Spacecraft Guidance

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SPACECRAFT INSTRUMENTATION AND ASTRIONICS

Includes the design, manufacture, or use of devices for the purpose of measuring, detecting, controlling, computing, recording, or processing data related to the operation of space vehicles or platforms. For related information see also *06 Avionics and Aircraft Instrumentation*; for spaceborne instruments not integral to the vehicle itself see *35 Instrumentation and Photography*; for spaceborne telescopes and other astronomical instruments see *89 Astronomy*.

20100018418 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Under the Radar: Trials and Tribulations of Landing on Mars
Bailey, Erik; Chen, Curtis; Shaffer, Scott; Skulsky, Eli D.; February 1, 2008; In English; Rocky Mountain Section 31st Annual GN and C Conference, 1-6 Feb. 2008, Breckenridge, CO, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41542

The Mars Phoenix Mission requires a ground-sensing radar altimeter/ velocimeter to meet touchdown velocity requirements During Phase C/D, the radar underwent a testing triptych: a) Aerial Testing, both captive carry and tethered drop tests (36 sorties, approx. 80 hrs). b) Testing with Electronic Ground Support Equipment (EGSE) on the bench (500+ hrs). c) Detailed Simulation including both RF physics and internal firmware logic (100,000+ simulated landings). All three venues were implemented to provide sufficient uniqueness and overlap to: a) Verify the radar is meeting its requirements. b) Validate radar performance within the flight system and environment. Significant discoveries were attributed to each of the three elements of the testing triptych, leading to greatly improved EDL system robustness. An overview of the testing triptych methodology, discoveries, and responses to them will be subsequently discussed.
Author
Radio Altimeters; Velocity Measurement; Ground Support Equipment; Electronic Equipment; Drop Tests; Mars Landing; Mars Missions

20100018591 NASA Johnson Space Center, Houston, TX, USA
Development of a Contingency Gas Analyzer for the Orion Crew Exploration Vehicle
Niu, Bill; Carney, Kenneth; Steiner, George; OHarra, William; Lewis, John; [2010]; 7 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): NNJ06TA25C
Report No.(s): JSC-CN-20601; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018591

NASA's experience with electrochemical sensors in a hand-held toxic gas monitor serves as a basis for the development of a fixed on-board instrument, the Contingency Gas Analyzer (CGA), for monitoring selected toxic combustion products as

well as oxygen and carbon dioxide on the Orion Crew Exploration Vehicle (CEV). Oxygen and carbon dioxide are major components of the cabin environment and accurate measurement of these compounds is critical to maintaining a safe working environment for the crew. Fire or thermal degradation events may produce harmful levels of toxic products, including carbon monoxide (CO), hydrogen cyanide (HCN), and hydrogen chloride (HCl) in the environment. These three components, besides being toxic in their own right, can serve as surrogates for a panoply of hazardous combustion products. On orbit monitoring of these surrogates provides for crew health and safety by indicating the presence of toxic combustion products in the environment before, during and after combustion or thermal degradation events. Issues identified in previous NASA experiences mandate hardening the instrument and components to endure the mechanical and operational stresses of the CEV environment while maintaining high analytical fidelity. Specific functional challenges involve protecting the sensors from various anticipated events- such as rapid pressure changes, low cabin pressures, and extreme vibration/shock exposures- and extending the sensor lifetime and calibration periods far beyond the current state of the art to avoid the need for on-orbit calibration. This paper focuses on lessons learned from the earlier NASA hardware, current testing results, and engineering solutions to the identified problems. Of particular focus will be the means for protecting the sensors, addressing well known cross-sensitivity issues and the efficacy of a novel self monitoring mechanism for extending sensor calibration periods.
Author
Gas Analysis; Gas Detectors; Pressurized Cabins; Carbon Monoxide; Crew Exploration Vehicle; Hydrocyanic Acid; Thermal Degradation

20100019260 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Geostationary Operational Satellite R Series SpaceWire Based Data System Architecture
Krimchansky, Alexander; Anderson, William H.; Bearer, Craig; June 21, 2010; 8 pp.; In English; Session: SpaceWire Missions and Applications, 21-23, Jun. 2010, Saint Petersburg, Russia; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019260
The GOES-R program selected SpaceWire as the best solution to satisfy the desire for simple and flexible instrument to spacecraft command and telemetry communications. Data generated by GOES-R instruments is critical for meteorological forecasting, public safety, space weather, and other key applications. In addition, GOES-R instrument data is provided to ground stations on a 24/7 basis. GOES-R requires data errors be detected and corrected from origin to final destination. This paper describes GOES-R developed strategy to satisfy this requirement
Author
Geosynchronous Orbits; Telemetry; Spacecraft Communication; Ground Stations; Space Weather; Synchronous Platforms

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SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20100018609 Air Force Research Lab., Edwards AFB, CA USA
Review of the Electric Propulsion Space Experiment (ESEX) Program (Postprint)
Bromaghim, D R; LeDuc, J R; Salasovich, R M; Spanjers, G G; Fife, J M; Dulligan, M J; Schilling, J H; White, D C; Johnson, L K; Jan 2002; 9 pp.; In English
Report No.(s): AD-A517682; AFRL-PR-ED-TP-2001-033; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517682
The U.S. Air Force Research Laboratory's Electric Propulsion Space Experiment was launched and successfully operated on the Advanced Research and Global Observation Satellite, demonstrating the compatibility and readiness of high-power electric propulsion. This flight was the culmination of an Air Force technology program to demonstrate the applicability of high-power electric propulsion for satellite applications. A brief history of the program is presented, followed by a description of the flight operations, which successfully demonstrated the critical system components, the arcjet, power processor, and propellant feed system, verifying the interoperability of high-power electric propulsion with satellite operations. The two

anomalies experienced during on-orbit operations, and their proposed causes, are also described.
DTIC
Electric Propulsion; Spaceborne Experiments

20100019165 NASA Glenn Research Center, Cleveland, OH, USA
Fission Surface Power Technology Development Status
Palac, Donald T.; Mason, Lee S.; Houts, Michael G.; Harlow, Scott; April 2010; 16 pp.; In English; Space 2009 Conference and Exposition, 14-17 Sep. 2009, Pasadena, CA, USA; Original contains color illustrations
Report No.(s): NASA/TM-2010-216249; AIAA Paper 2009-6535; E-17236; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019165

Power is a critical consideration in planning exploration of the surfaces of the Moon, Mars, and beyond. Nuclear power is an important option, especially for locations in the solar system where sunlight is limited in availability or intensity. NASA is maintaining the option for fission surface power for the Moon and Mars by developing and demonstrating technology for an affordable fission surface power system. Because affordability drove the determination of the system concept that this technology will make possible, low development and recurring costs result, while required safety standards are maintained. However, an affordable approach to fission surface power also provides the benefits of simplicity, robustness, and conservatism in design. This paper will illuminate the multiplicity of benefits to an affordable approach to fission surface power, and will describe how the foundation for these benefits is being developed and demonstrated in the Exploration Technology Development Program s Fission Surface Power Project.
Author
Fission; Moon; Low Cost; Nuclear Electric Power Generation

20100020152 Environmental Protection Agency, Washington, DC, USA
Clean Automotive Technology Program: Developing Cleaner and More Efficient Vehicles and Engines for Tomorrow. 2006 Progress Report
November 2006; 20 pp.; In English
Report No.(s): PB2010-108652; EPA-420-R-06-008; No Copyright; Avail.: National Technical Information Service (NTIS)

Transportation and mobility are central to the American economy and way of life. While the world's desire for personal mobility and commercial transportation has evolved, so have the geopolitical and environmental landscapes. Global demand for oil is at an all-time high, driving up the price of gasoline and diesel fuel, and the environmental consequences of mobile source emissions have become more and more apparent. More than 100 million Americans live in counties that do not attain federal clean air standards for ozone (O3), sulfur dioxide (SO2), particulate matter (PM), or other air pollutants, mostly because of emissions from the transportation sector. Transportation sources are also responsible for emitting prodigious amounts of carbon dioxide (CO2), a greenhouse gas that is accelerating global climate change. In fact, transportation was the second largest source of CO2 in the USA in 2004, accounting for approximately 30 percent of national CO2 emissions. In response, the U.S. Environmental Protection Agency's (EPA's) Office of Transportation and Air Quality (OTAQ) is spearheading a range of programs to reduce mobile source emissions.
NTIS
Air Quality; Automobiles; Cleaners; Motor Vehicles; Technology Assessment

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CHEMISTRY AND MATERIALS (GENERAL)

Includes general research topics related to the composition, properties, structure, and use of chemical compounds and materials as they relate to aircraft, launch vehicles, and spacecraft. For specific topics in chemistry and materials see *categories 25 through 29*. For astrochemistry see category *90 Astrophysics*.

20100018487 Pakistan Council of Scientific and Industrial Research, Karachi, Pakistan
Pakistan Journal of Scientific and Industrial Research, Vol. 53, no. 1, January-February, 2010
February 2010; 64 pp.; In English
Report No.(s): PB2010-106051; PSIRAA 53 (1) 1-58 2010; No Copyright; Avail.: CASI: A04, Hardcopy

This document presents the abstracts on the physical sciences, the biological sciences, and the short communication.
NTIS
Chemical Engineering; Pakistan; Abstracts

20100018489 California Univ., Santa Barbara, CA, USA
Development of High-Temperature Ferritic Alloys and Performance Prediction Methods for Advanced Fission Energy Systems
Odette, G. Robert; Yamamoto, Takuya; August 14, 2009; 110 pp.; In English
Contract(s)/Grant(s): DE-FC07-05ID14663; Proj. No. 05-074
Report No.(s): DE2009-964387; DOE/ID/14663; No Copyright; Avail.: National Technical Information Service (NTIS)
Reports the results of a comprehensive development and analysis of a database on irradiation hardening and embrittlement of tempered martensitic steels (TMS). Alloy specific quantitative semi-empirical models were derived for the dpa dose, irradiation temperature (ti) and test (Tt) temperature of yield stress hardening (or softening) .
NTIS
Fission; Heat Resistant Alloys; Performance Prediction; Prediction Analysis Techniques

20100018519 Technische Univ., Delft, Netherlands
Heron: Volume 55, No. 1
January 2009; 88 pp.; In English
Report No.(s): PB2010-106103; No Copyright; Avail.: CASI: A05, Hardcopy
;Contents: Behaviour of High Strength Steel Moment Joints; Finite Element Analysis of Damage in Pipeline Bends; and P-I Diagrams for Linear-Elastic Cantilevered Timoshenko Beams Including Higher Modes of Vibration.
NTIS
Construction Industry; Research and Development

20100018520 Pakistan Council of Scientific and Industrial Research, Karachi, Pakistan
Pakistan Journal of Scientific and Industrial Research, Vol. 52, No. 5, September-October, 2009
October 2009; 58 pp.; In Mixed
Report No.(s): PB2010-106090; No Copyright; Avail.: CASI: A04, Hardcopy
;Contents: Physical Sciences; Biological Sciences; Short Communication, and Technology.
NTIS
Chemical Engineering; Pakistan

20100018521 Budapest Univ. of Technology and Economics, Budapest, Hungary
Periodica Polytechnica, Mechanical Engineering, Volume 52, No. 1, 2008
January 18, 2008; 48 pp.; In Mixed; In English
Report No.(s): PB2010-106089; No Copyright; Avail.: CASI: A03, Hardcopy
;Contents: Magnetic saturation of poly(dimethyl-siloxane) matrix composites based magnetorheological elastometers; Analysis of colour moire phenomenon in colour space; Influence of the infiltration pressure on the properties of MMC wires; A transformation technique for efficient shape optimization in CAD/CAE environment; Human weaknesses and strengths in collaboration with robots; and Producing metal matrix syntactic foams by pressure infiltration.
NTIS
Mechanical Engineering; Shape Optimization; Pressure Effects; Elastometers

20100018736 Naval Research Lab., Washington, DC USA
Innovative Ionic Liquids: Electrolytes for Ion Power Sources
Sutto, T E; Kim, H S; Pique, A; Jan 2008; 4 pp.; In English
Report No.(s): AD-A518005; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518005
As technologies evolve from fixed-site equipment to warfighter-portable devices, the need for safe, compact, rechargeable power sources continues to grow. In spite of the emphasis on high energy density lithium ion (Li-ion) power sources, the fire and/or explosive hazards of these severely limit their utility to the warfighter. Logistical concerns further compound these difficulties, and are reflected in numerous federal and international regulations that limit how, and how many, lithium ion batteries can be shipped together. Thus, a twofold problem exists: increasing the energy density of batteries, while at the same time improving the safety of these devices to enhance their utility to the U.S. Navy and the Joint Services. The key component responsible for the hazards associated with lithium ion batteries is the electrolyte. Typically, these electrolytes, even in gel form, are more flammable than jet fuels. Therefore, enhancing the safety of these systems is dependent on being able to replace

these common electrolytes with a safer system. An ideal replacement choice is ionic liquids (ILs). ILs are organic-based molten salts that are liquid at ambient temperatures. In general, the composition of these ILs incorporates a thermally and electrochemically stable, positively charged ring system, and an anion, such as a perfluorinated imide. It is this thermal and electrochemical stability and the stability of the organic components that have made ILs attractive alternatives to the more common organic solvents. As salts, the ILs are highly ionically conductive, have nearly no vapor pressure, and as such are non-volatile. Thermal analysis indicates that not only are they stable to over 350 deg C, but also they do not explosively ignite as most other common organic solvents do, but instead thermally degrade by charring.
DTIC
Electric Batteries; Electrolytes; Fluorination; Gels; Imides; Ion Sources; Liquids; Lithium Batteries; Vapor Pressure

20100018752 Naval Research Lab., Washington, DC USA
Reducing Corrosion Control Costs with Rapid-Cure Coatings
Webb, A A; Verborgt, J; Martin, J R; Groeninger, W; Slebodnick, P F; Lucas, K E; Hogan, E; Jan 2007; 8 pp.; In English
Report No.(s): AD-A518044; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518044

NRL's Center for Corrosion Science and Engineering began work on the ONR Future Naval Capabilities (FNC) Single Coat Program in 2000. The goal was to reduce maintenance time and provide cost savings by introducing rapid-cure coatings technology to the fleet. Since program inception, NRL in conjunction with NAVSEA05M has successfully demonstrated the new rapid-cure coatings and advanced application process in more than 60 ship ballast tanks, comprising nearly 200,000 ft2. There have been no reported in-service failures, the program has demonstrated costs savings of 25-30%, and the Navy will benefit greatly from a new class of qualified coatings. In addition to working with commercial partners, the Marine Coatings Section patented a new resin system and has formulated a new series of solvent-free, rapidcure coatings designed specifically for shipboard use. These coatings, currently known as novel resins, are cost-competitive with existing products and are of great interest commercially. They are scheduled for upcoming ship demonstration and final qualification.
DTIC
Coatings; Corrosion; Corrosion Prevention; Cost Reduction; Costs

20100018920 Army Research Lab., Aberdeen Proving Ground, MD USA
A Detailed, Finite-Rate, Chemical Kinetics Mechanism for Monomethylhydrazine-Red Fuming Nitric Acid Systems
Anderson, William R; McQuaid, Michael J; Nusca, Michael J; Kotlar, Anthony J; Feb 2010; 36 pp.; In English
Contract(s)/Grant(s): Proj-AH43
Report No.(s): AD-A518433; ARL-TR-5088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Between 2003 and 2005, a detailed, multistep, finite-rate chemical kinetics mechanism was developed to provide a basis for modeling monomethylhydrazine-red fuming nitric acid (MMH-RFNA) ignition and combustion chemistry. It was assembled almost entirely from reaction rate expressions and thermochemical data developed and validated for other combustion systems. When the mechanism's development was discontinued in 2005, it was composed of rate expressions for 513 reactions and involved 81 species. A lack of relevant experimental data limited the extent to which it could be validated as a whole. Nevertheless, when a subset of the mechanism was employed as a submodel for a computational fluid dynamics (CFD) model of an impinging stream vortex engine (ISVE) fueled with MMH-RFNA, the CFD model produced simulations whose calculations for chamber pressure and thrust well-reproduced ISVE test firing data. As such, the mechanism is considered to have a reasonable measure of validity and, thus, to be a good starting point for obtaining more refined MMH-RFNA mechanisms. This report discusses the mechanism's development and provides the rate expressions and thermochemical data that compose it. The sources of the rate expressions and thermochemical data are also provided.
DTIC
Combustion; Ignition; Methylhydrazine; Monomethylhydrazines; Nitric Acid; Reaction Kinetics

20100019021 Naval War Coll., Newport, RI USA
Gunboats for China's New 'Grand Canals'? Probing the Intersection of Beijing's Naval and Oil Security Policies
Erickson, Andrew; Goldstein, Lyle; Jan 2009; 35 pp.; In English
Report No.(s): AD-A518710; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over a millennium ago, a waterway known as the Grand Canal, connecting the seaport of Hangzhou with Beijing in the north, became a critical artery for the dynamic growth of Chinese civilization. In the last decade, the sea lines of communication (SLOCs) connecting China to the Middle East and Africa have assumed a similarly vital role as a major center

of gravity for Chinese economic development. With Chinese oil demand growing rapidly and seaborne oil imports constituting more than 80 percent of total oil imports, China's new Grand Canal has also become a vital oil lifeline. In 2007, approximately 85 percent of Chinese oil imports passed through the Strait of Malacca; Chinese writings commonly refer to this critical vulnerability as the Malacca Dilemma. Given these developments, along with the 26 December 2008 deployment of two destroyers and one supply vessel from the People's Liberation Army Navy (PLAN) to support counter-piracy operations in the Gulf of Aden, it is time to consider seriously the prospect of future PLAN missions to defend Chinese interests not only in East Asia but also beyond.
DTIC
Boats; Canals; China; Fossil Fuels; Oils; Policies; Security

20100019379 Sitek Research Labs., Rockville, MD USA
In Vivo Test for Chemical Induction of Micronucleated Polychromatic Erythrocytes in Mouse Bone Marrow Cells, Test Article: Ethylenediamine Dinitrate (EDDN)
Shore, Karen; Kirby, Paul; Aug. 5, 2009; 64 pp.; In English
Contract(s)/Grant(s): W91ZLK-09-P-0958
Report No.(s): AD-A518233; FR-1003-1521; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518233

Ethylenediamine dinitrate (EDDN) (99.5% pure) was tested forclastogenic potentials to induce micronucleated polychromatic erythrocytes (MPCE) in the bone marrow cells of male and femal CD-1 mice according to OECD TG 474 in compliance with Good Laboratory Practice. Male and female mice were dosed orally at 500, 1000, and 2000 mg/kg. Animals were euthanized approximately 24 and 48 hr after dosing. The percentage of polychromatic erythrocytes (PCE) and frequency of micronucleated polychromatic erythrocyte (MPCE) were determined at 24 and 48 hours. Cytotoxicity was assessed by scoring the number of PCE and norchromatic erythrocyte (NCE) in first 200 erythrocytes for each animal. There were not statistically significant increases in the number of MPCE in the treated groups when compared to the concurrent vehicle control group. These results indicate that EDDN was negative in the in vivo mouse micronucleus assay and therefore is not considered to be a clastogenic agent.
DTIC
Bone Marrow; Cells (Biology); Dinitrates; Erythrocytes; Ethylenediamine; In Vivo Methods and Tests; Mice

20100019425 Army Tank-Automotive Research and Development Command, Warren, MI USA
What Are We Looking For? Research Being Conducted
Villahermosa, Luis A.; February 17, 2010; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518026; RDECOM-20558RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518026

The objectives of this research are to develop a new model for predicting thermal conductivity of nanoparticle fluids by incorporating particle properties, and develop suitable analytical methods to experimentally investigate the nanofluid systems, particle characteristics, and preparation methods for controlling nanofluid properties.
DTIC
Energy Policy; Thermal Conductivity

20100019521 Texas Univ., Austin, TX, USA
Molecular Design of Colloids in Supercritical Fluids
Johnston, K. P.; Apr. 06, 2009; 12 pp.; In English
Contract(s)/Grant(s): FG02-04ER15549
Report No.(s): DE2010-950785; DOE/ER/15549-1; No Copyright; Avail.: Department of Energy Information Bridge

The environmentally benign, non-toxic, non-flammable fluids water and carbon dioxide (CO2) are the two most abundant and inexpensive solvents on earth. Emulsions of these fluids are of interest in many industrial processes, as well as CO2 sequestration and enhanced oil recovery. Until recently, formation of these emulsions required stabilization with fluorinated surfactants, which are expensive and often not environmentally friendly. In this work we overcame this severe limitation by developing a fundamental understanding of the properties of surfactants the CO2-water interface and using this knowledge to design and characterize emulsions stabilized with either hydrocarbon-based surfactants or nanoparticle stabilizers. We also

discovered a new concept of electrostatic stabilization for CO2-based emulsions and colloids. Finally, we were able to translate our earlier work on the synthesis of silicon and germanium nanocrystals and nanowires from high temperatures and pressures to lower temperatures and ambient pressure to make the chemistry much more accessible.
NTIS
Colloids; Supercritical Fluids

20100019533 Harvard Univ., Cambridge, MA, USA
Multiscale Studies of the Formation and Stability of Surface-Based Nanostructures
Kaxiras, E.; Jan. 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-FG02-05ER46226
Report No.(s): DE2010-946728; No Copyright; Avail.: Department of Energy Information Bridge

This research consisted of a theoretical investigation of the properties of surface-based nanostructures, having as a main goal the deeper understanding of the atomic-scale mechanisms responsible for the formation and stability of such structures. This understanding will lead to the design of improved systems for applications in diverse areas such as novel electronic devices, sensors, field-effect transistors, substrates with enhanced hydro-phobic (water repelling) or hydro-philic (water absorbing) behavior for coatings of various surfaces used in bioengineering, flexible displays, organic photovoltaics, etc. The research consisted of developing new theoretical methodologies and applying them to a wide range of interesting physical systems. Highlights of the new methodologies include techniques for bridging different scales, from the quantum-mechanical electronic level to the meso-scopic level of large molecular structures such as DNA, carbon nanotubes and two-dimensional assemblies of organic molecules. These methodologies were successfully applied to investigate interactions between systems that are large on the atomic scale (reaching the scale of microns in length or milliseconds in time), but still incorporating all the essential elements of the atomic-scale structure. While the research performed here did not address applications directly, the implications of its finding are important in guiding experimental searches and in coming up with novel solutions to important problems. In this sense, the results of this work can be incorporated in the design of many useful applications.
NTIS
Nanostructures (Devices); Stability

20100019744 Army Research Lab., Aberdeen Proving Ground, MD USA
Energy Partitioning and Impulse Dispersion in the Decorated, Tapered, Strongly Nonlinear Granular Alignment: A System with Many Potential Applications
Doney, Robert L; Agui, Juan H; Sen, Surajit; Mar 2010; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519114; ARL-RP-289; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519114

Rapid absorption of impulses using light-weight, small, reusable systems is a challenging problem. An axially aligned set of progressively shrinking elastic spheres, a tapered chain, has been shown to be a versatile and scalable shock absorber in earlier simulational, theoretical, and experimental works by several authors. We have recently shown (see R. L. Doney and S. Sen, Phys. Rev. Lett. 97, 155502 (2006)) that the shock absorption ability of a tapered chain can be dramatically enhanced by placing small interstitial grains between the regular grains in the tapered chain systems. Here we focus on a detailed study of the problem introduced in the above mentioned letter, present extensive dynamical simulations using parameters for a titanium-aluminum-vanadium alloy Ti6Al4V, derive attendant hard-sphere analyses based formulae to describe energy dispersion, and finally discuss some preliminary experimental results using systems with chrome spheres and small Nitinol interstitial grains to present the underlying nonlinear dynamics of this so-called decorated tapered granular alignment. We are specifically interested in small systems, comprised of several grains. This is because in real applications, mass and volume occupied must inevitably be minimized. Our conclusion is that the decorated tapered chain offers enhanced energy dispersion by locking in much of the input energy in the grains of the tapered chain rather than in the small interstitial grains. Thus, the present study offers insights into how the shock absorption capabilities of these systems can be pushed even further by improving energy absorption capabilities of the larger grains in the tapered chains. We envision that these scalable, decorated tapered chains may be used as shock absorbing components in body armor, armored vehicles, building applications and in perhaps even in applications in rehabilitation science.
DTIC
Energy Absorption; Granular Materials; Impulses; Nonlinear Systems; Shock Absorbers

20100019937 University of Central Florida, Orlando, FL USA

Atmosphere Issues in Detection of Explosives and Organic Residues

Brown, C G; Baudelet, M; Bridge, C; Fisher, M K; Sigman, M; Dagdigian, P J; Richardson, M; Jan 2009; 13 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0446

Report No.(s): AD-A519498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study makes a comparison of LIBS emission from molecular species in plasmas produced from organic residues on a non-metallic substrate by both a 5 ns Nd:YAG laser (1064 nm) and a 40 fs Ti:Sapphire laser (800 nm) in air and argon atmospheres. The organic samples analyzed had varying amounts of carbon, nitrogen, hydrogen, and oxygen in their molecular structure. The characterization was based on the atomic carbon, hydrogen, nitrogen, and oxygen lines as well as the diatomic species CN (Beta sq Sigma+ - Chi sq Sigma+) and the C2 (d3 Pi(g) - a3 Pi(u)). Principal Component Analysis (PCA) was used to identify similarities of the organic analyte via the emission spectra. The corresponding Receiver Operating Characteristics (ROC) curves show the limitations of the PCA model for the nanosecond regime in air.

DTIC

Atomic Spectra; Detection; Explosives; Explosives Detection; Organic Materials; Residues; Spectroscopy

20100019943 University of Central Florida, Orlando, FL USA

Nd:YAG-CO2 double-pulse laser induced breakdown spectroscopy of organic films

Weidman, Matthew; Baudelet, Matthieu; Palanco, Santiago; Sigman, Michael; Dagdigian, Paul J; Richardson, Martin; Jan 5, 2010; 9 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0446

Report No.(s): AD-A519506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Laser-induced breakdown spectroscopy (LIBS) using doublepulse irradiation with Nd:YAG and CO2 lasers was applied to the analysis of a polystyrene film on a silicon substrate. An enhanced emission signal, compared to single-pulse LIBS using a Nd:YAG laser, was observed from atomic carbon, as well as enhanced molecular emission from C2 and CN. This double-pulse technique was further applied to 2,4,6-trinitrotoluene residues, and enhanced LIBS signals for both atomic carbon and molecular CN emission were observed; however, no molecular C2 emission was detected.

DTIC

Carbon Dioxide; Laser Applications; Laser-Induced Breakdown Spectroscopy; Lasers; Organic Materials; Pulsed Lasers; Spectroscopy; YAG Lasers; Yttrium-Aluminum Garnet

20100019949 Johns Hopkins Univ., Baltimore, MD USA

Kinetic Model of C/H/N/O Emissions in Laser-Induced Breakdown Spectroscopy of Organic Compounds

Dagdigian, Paul J; Khachatrian, Ani; Babushok, Valeri I; May 1, 2010; 10 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0446

Report No.(s): AD-A519518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A kinetic model to predict the relative intensities of the atomic C/H/N/O emission lines in laser-induced breakdown spectroscopy (LIBS) has been developed for organic compounds. The model includes a comprehensive set of chemical processes involving both neutral and ionic chemistry and physical excitation and de-excitation of atomic levels affecting the neutral, ionic, and excited-state species concentrations. The relative excited-state atom concentrations predicted by this modeling are compared with those derived from the observed LIBS intensities for 355nm ns laser irradiation of residues of two organic compounds on aluminum substrate. The model reasonably predicts the relative excited-state concentrations, as well as their time profiles. Comparison of measured and computed concentrations has also allowed an estimation of the degree of air entrainment.

DTIC

Atomic Spectra; Kinetics; Laser-Induced Breakdown Spectroscopy; Lasers; Organic Compounds; Spectroscopy

20100019990 Drexel Univ., Philadelphia, PA USA

Preignition and Autoignition Behavior of the Xylene Isomers

Natelson, Robert H; Mar 2010; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0070; W911NF-07-1-0522

Report No.(s): AD-A519619; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The relative preignition and autoignition reactivity of o-, m- and p-xylene has been studied. Preignition experiments were conducted in a pressurized flow reactor facility at 600-850 K temperatures, 8 atm pressure, and lean equivalence ratios.

Analysis of the data included carbon monoxide and carbon dioxide measurements using a nondispersive infrared analyzer and molecular oxygen measurements using an electrochemical oxygen cell. Identification of intermediate species was performed using gas chromatography with flame ionization detection and a mass spectrometer. Additional experiments were conducted in a single cylinder research engine. Neat o- and m-xylene were oxidized in the reactor under preignition conditions. They showed no reactivity, so mixtures of each isomer with n-dodecane were tested and compared, and intermediate species were identified. This data helped resolve a recent controversy regarding the relative reactivity of the xylene isomers. To study the autoignition of the xylenes, the isomers neat, in binary mixtures with n-decane, and in six-component JP-8 surrogates were tested in the single cylinder research engine. The experimental data were analyzed and compared to existing chemical kinetic models, and it was concluded that at lower temperatures (850 K), the xylenes show similar reactivity, and at higher temperatures, o-xylene is the more reactive isomer.
DTIC
Ignition; Isomers; Spontaneous Combustion; Xylene

20100020026 Johns Hopkins Univ., Baltimore, MD USA
Comparison of Laser-Induced Breakdown Spectra of Organic Compounds with Irradiation at 1.5 and 1.064 micrometers
Wong, Diane M; Dagdigian, Paul J; Jan 2008; 10 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446; W911NF-06-1-0206
Report No.(s): AD-A519718; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A comprehensive investigation of laser-induced breakdown spectroscopy (LIBS) at 1.500 micrometers of residues of six organic compounds (anthracene, caffeine, glucose, 1,3-dinitrobenzene, 2,4-dinitrophenol, and 2,4-dinitrotoluene) on aluminum substrates is presented and compared with LIBS at the Nd:YAG fundamental wavelength of 1.064 micrometers. The overall emission intensities were found to be smaller at 1.500 micrometers than at 1:064 micrometers, and the ratios of C2 and CN molecular emissions to the H atomic emissions were observed to be less. Possible reasons for the observed differences in LIBS at 1.064 micrometers versus 1.500 micrometers are discussed.
DTIC
Emission Spectra; Irradiation; Laser Spectroscopy; Laser-Induced Breakdown Spectroscopy; Organic Compounds; YAG Lasers

20100020284 Dayton Univ. Research Inst., Urdi, OH USA; Air Force Research Lab., Wright-Patterson AFB, OH, USA
Effect of Diethylene Glycol Monomethyl Ether (DiEGME) and Triethylene Glycol Monomethyl Ether (TriEGME) on Microbial Contaminants in Aviation Fuel
Balster, Lori M. T.; Vangsness, Marlin D.; Bowen, Loryn L.; Mueller, Susan S.; Brown, Lisa M.; Strobel, Ellen M.; Pike, Daniel L.; March 2010; 56 pp.; In English
Contract(s)/Grant(s): F33615-03-2-2347; Proj-3048; 62203F
Report No.(s): AD-A519639; AFRL-RZ-WP-TR-2010-2094; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Diethylene glycol monomethyl ether (DiEGME) is widely used in military aircraft to inhibit both fuel system icing and microbial growth. However, due to the deleterious effects of the additive, the RTOC program was conducted to determine if it is possible to replace DiEGME in military aircraft fuel. The study presented here was performed in support of this program, which was designed to investigate the possible mission impact of replacing DiEGME with TriEGME. The current study was confined to the impact upon the biocidal/biostatic properties of the proposed additive. This study suggests that similar amounts of DiEGME and TriEGME are needed to retain biocidal/biostatic effectiveness, and that the substitution of TriEGME for DiEGME will result in equivalent protection from microbial contaminants.
DTIC
Additives; Aircraft Fuels; Antibiotics; Antiinfectives and Antibacterials; Bacteria; Biological Effects; Contaminants; Contamination; Ethers; Ethylene Compounds; Fungi; Glycols; Microorganisms

24
COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.

20100018376 Oregon Dept. of Transportation, Salem, OR USA
Preliminary Investigation of RAP and RAS in HMAC
Scholz, Todd V.; February 2010; 50 pp.; In English
Contract(s)/Grant(s): SR 500-291
Report No.(s): PB2010-105919; OR-RD-20-12; No Copyright; Avail.: National Technical Information Service (NTIS)

A laboratory study was undertaken to investigate how various proportions of reclaimed asphalt pavement (RAP) and reclaimed asphalt shingles (RAS) added to hot mixed asphalt concrete (HMAC) mixtures affect the Superpave performance grade of the blended binder. Only tear-off shingles (those obtained from re-roofing projects of residential structures) were included in the study. Critical temperatures of the blended asphalt binders from mixtures with 5% RAS and 0% to 50% RAP were compared with the critical temperatures of the virgin binder. Results indicated that the mixture with 5% RAS but no RAP resulted in an increase of the performance grade of the blended binder. Binders recovered from the mixtures with both RAP and RAS indicated an increase in both the high temperature and low temperature performance grades of the blended binder with increasing RAP contents up to about 30%. RAP contents above 30% did not result in any further increases in the low temperature performance grade and only slightly impacted the high temperature performance grade of the blended binders (the high temperature performance grade of the blended binder asymptotically approached that of the high temperature performance grade of the RAP binder). A secondary objective was to develop recommendations for changes to the mix design method and specifications for HMAC, incorporating RAS and RAP for use in special provisions for a pilot study. Specifications and special provisions of several agencies that allow tear-off RAS, and particularly those that allow tear-off RAS and RAP together, were reviewed to determine restrictions, criteria, test methods, mix design procedures, etc. applicable to inclusion of RAS and RAP in HMAC paving mixtures. Proposed modifications to ODOT specification SP745 were developed from this review.

NTIS
Asphalt; Pavements

20100018597 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Fatigue Behavior of an Advanced SiC/SiC Composite with an Oxidation Inhibited Matrix at 1200 deg C in Air and in Steam
Delapasse, Jacob; Mar 2010; 201 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517389; AFIT/GAE/ENY/10-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517389

The fatigue behavior of an advanced Silicon Carbide/Silcon (SiC/SiC) ceramic matrix composite (CMC) with oxidation inhibited matrix was investigated at 1200 deg C in laboratory air and in steam environments. The composite consisted of an oxidation inhibited SiC matrix reinforced with Hi-Nicalon fibers coated with pyrolytic carbon (PyC) with a boron carbide overlay woven into eight-harness-satin (8HS) weave plies. Tensile stress-strain behavior and tensile properties were evaluated at 1200-C. Tension-tension fatigue tests were conducted in both laboratory air and in steam at 1200 deg C at frequencies of 0.1 Hz, 1.0 Hz, and 10 Hz. The tension-tension fatigue tests had a ratio of minimum stress to maximum stress of R = 0.05, with maximum stresses ranging from 100 to 140 MPa in air and in steam. Fatigue run-out was defined as 105 cycles for the 0.1 Hz tests and as 2 x 105 cycles for the 1.0 Hz and 10 Hz tests. Strain accumulation with cycles and modulus evolution with cycles were analyzed for each fatigue test. The presence of steam degraded the fatigue resistance of the material at 0.1 Hz and 10 Hz. At 1.0 Hz, the presence of steam appeared to have little influence on the fatigue resistance for the fatigue stress levels 140 MPa. The presence of steam degraded the fatigue performance of the CMC at 1.0 Hz for the fatigue stress level of 140 MPa. Fatigue limit was 100 MPa (32.6% UTS) in air and steam at 1.0 Hz and in steam at 0.1 Hz. Fatigue limit was 140 MPa (45.6%) in air at 10 Hz. Specimens that achieved run-out were subjected to tensile tests to failure to characterize the retained tensile properties. Specimens tested in air retained 42-61% of their tensile strength and specimen tested in steam retained 59-75% of their tensile strength. The modulus loss in air and in steam was limited to 56%.

DTIC
Ceramic Matrix Composites; Oxidation; Steam

20100018603 Naval Undersea Warfare Center, Newport, RI USA

Dynamic Response and Damage Evolution in Composite Materials Subjected to Underwater Explosive Loading: An Experimental and Computational Study

LeBlanc, James; Shukla, Arun; Jan 2010; 11 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0268

Report No.(s): AD-A517585; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517585

The effect of underwater shock loading on an E-Glass/Epoxy composite material has been studied. The work consists of experimental testing, utilizing a water filled conical shock tube and computational simulations, utilizing the commercially available LS-DYNA finite element code. Two test series have been performed and simulated: (1) a reduced energy series which allowed for the use of strain gages and (2) a series with increased energy which imparted material damage. The strain gage data and the computational results show a high level of correlation using the Russell error measure. The finite element models are also shown to be able to simulate the onset of material damage by both in-plane and delamination mechanisms. DTIC

Composite Materials; Damage; Dynamic Response; Underwater Explosions

20100018702 Minnesota Univ., Minneapolis, MN USA

Optimization of Composite Structures Subject to Local Stress Constraints

Lipton, Robert; Stuebner, Michael; May 2005; 19 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0041; FA9550-05-1-0008

Report No.(s): AD-A517920; IMA-PREPRINT-SER-2043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517920

An extension of current methodologies is introduced for optimization of graded microstructure subject to local stress criteria. The method is based on new multiscale stress criteria given by macrostress modulation functions. The modulation functions quantify the intensity of local stress fluctuations at the scale of the microstructure due to the imposed macroscopic stress. The methodology is illustrated for long cylindrical shafts reinforced with stiff cylindrical elastic fibers with generators parallel to the shaft. Examples are presented for shaft cross sections that possess reentrant corners typically seen in lap joints and junctions of struts. It is shown that the computational methodology delivers graded fibers microgeometries that provide overall structural rigidity while at the same time tempering the influence of stress concentrations near reentrant corners. DTIC

Composite Structures; Microstructure

20100018803 Metis Design Corp., Cambridge, MA USA

Tomographic Electrical Resistance-based Damage Sensing in Nano-Engineered Composite Structures

Wicks, Sunny S; Guzman de Villoria, Roberto; Wardle, Brian L; Raghavan, Ajay; Kessler, Seth; Apr 2010; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-09-C-0024

Report No.(s): AD-A518170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518170

Aligned carbon nanotubes (CNTs) are being investigated as a means for enhancing structural performance of composite structures. Inherent in introducing CNTs into existing polymer-matrix composites are new multifunctional attributes such as significantly enhanced electrical conductivity and piezoresistivity that may be used for damage sensing and inspection. Here, fiber-reinforced polymer-matrix laminates with aligned CNTs grown in-situ are coupled with a non-invasive sensing scheme utilizing the enhanced electrical conductivity of the laminates to infer damage based on resistance changes. The laminates contain long (10 micron) aligned CNTs throughout the woven plies of the laminate, including at the ply interfaces. Electrodes are written onto the laminate surfaces using a direct-write process, and 3D damage inspection (in-plane and through-thickness) is demonstrated for impacted composite plates. DTIC

Carbon Nanotubes; Composite Structures; Damage; Detection; Electrical Resistance; Laminates; Tomography

20100018903 Intelligent Automation Systems, Inc., Rockville, MD USA

A Portable Hybrid Ultrasound-Eddy Current NDI System for Metal Matrix Composite Track Shoes

Zhao, Xiaoliang; Mi, Bao; Qian, Tao; Owens, Steven E; Royer, Jr, Roger L; Raju, Basavaraju B; Apr 10, 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W56HZV-04-C-0692

Report No.(s): AD-A518385; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Track shoes made of Metal Matrix Composite (MMC) are light in weight, and can resist high temperature and wear. Defects such as disbond, cracks and porosity can be introduced during the manufacturing process and while in service. Presented in this paper is a portable nondestructive inspection (NDI) system to automatically inspect the tank track shoes for disbond, cracks and porosity defects. The work focuses on the inspection of the track shoe center spline where MMC inserts are attached to the aluminum substrate. A hybrid approach has been developed where an array of broadband high frequency ultrasonic transducers operating in a pulse/echo mode are utilized to detect disbond, and a scanning eddy current probe array is used to detect cracks and porosity. The inspection results agree quite well with immersion ultrasonic C-scan images and destructive tests.

DTIC

Eddy Currents; Metal Matrix Composites; Nondestructive Tests; Shoes; Ultrasonics; Vehicular Tracks

20100019013 North Carolina Univ., Chapel Hill, NC USA

High-Performance Macromolecular Materials

Forest, M G; Feb 28, 2010; 9 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0063

Report No.(s): AD-A518688; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major accomplishments from this contract consist of new theoretical models for nano-rod and nano-platelet hydrodynamics, new algorithms for simulations of benchmark experiments and processing flows, new defect detection and tracking diagnostics, and the applications of each of these developments to understanding of these novel material systems and their flow-processing properties. The publications resulting from this contract can fairly be characterized as the state-of-the-art in the theory, modeling, simulations and behavior of nano-rod and nano-platelet dispersions.

DTIC

Composite Materials; Nanocomposites

20100019746 Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Munich, Germany

Stress Wave and Damage Propagation in Transparent Laminates at Elevated Temperatures

Strassburger, Elmar; Mar 2010; 58 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-08-1-2006

Report No.(s): AD-A519117; ARL-CR-639; E-13/09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519117

A series of studies has been conducted to visualize damage initiation and propagation in transparent armor materials like Starphire (a registered trademark of PPG Industries, Pittsburgh, PA) soda-lime glass, borosilicate glass, fused silica, and the transparent ceramic AlON. Since transparent armor consists of glass laminates with polymer interlayer and backing, the influence of interlayer type and thickness on damage propagation was also examined. The so-called Edge-on Impact method was applied to visualize stress wave and damage propagation in the previous sets of tests. Two different optical configurations were employed. A regular transmitted light shadowgraph setup was used to observe wave and damage propagation, and a modified configuration, where the specimens were placed between crossed polarizers, and the photoelastic effect was utilized to visualize the stress waves. Pairs of impact tests at approximately equivalent velocities were carried out in transmitted plane (shadowgraphs) and crossed polarized light. The focus of this study was on the investigation of the influence of a layer of strengthened glass or glass ceramic in a laminate target and the influence of elevated temperatures on wave and damage propagation.

DTIC

Damage; High Temperature; Laminates; Stress Waves; Transparence; Wave Propagation

20100019904 Washington State Univ., Pullman, WA USA

Multispectral Visible/Infrared Sensors Based on Polymer-Metal Nanocomposites

Eilers, Hergen; Jan 6, 2010; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0295

Report No.(s): AD-A519425; No Copyright; Avail.: Defense Technical Information Center (DTIC)

P3HT:PCBM based reference and active device structures, as well as Graetzel-cell type based reference and active structures were fabricated and their optical and electrical properties measured. The reference structures for both types showed the expected optical absorption in the visible wavelength range and the electrical performance was similar to results reported in the scientific literature. All of the active devices showed increased optical absorption in the near-infrared. The active device structures based on P3HT:PCBM showed an electrical short and no I-V

DTIC

Composite Materials; Infrared Detectors; Nanocomposites; Optical Measuring Instruments

20100020302 Universal Technology Corp., Dayton, OH USA

Collaborative Research and Development (CR and D). Delivery Order 0053: Multiscale Modeling Support

Patnaik, Soumya S.; February 2008; 27 pp.; In English

Contract(s)/Grant(s): F33615-03-D-5801-0053; Proj-4349; 62102F

Report No.(s): AD-A519700; S-531-053; AFRL-RX-WP-TM-2010-4090; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted at Wright-Patterson AFB, Ohio. Multi-scale modeling was carried out to study mechanical, thermal and interfacial properties of multifunctional polymers for application in hybrids and composites. In order to establish competency in the new area of molecular modeling of composites and identify technical gaps in molecular modeling of organic polymer matrix composites the issue of developing core competency in computational materials science addressing the Air Force's need for developing next generation of polymer matrix composites, was addressed. Multiple research proposals were submitted. Along with atomistic and coarse-grained molecular dynamics (MD), mesoscale and lattice modeling were also used. Atomistic MD was used to study interfacial properties where as coarse-grained (bead-spring model) MD was used to obtain a general understanding of how network structure controls the mechanical properties of highly crosslinked polymers. The network formation of cross-linked polymers was studied using discrete lattice models. The mechanical properties of crosslinked thermoset molecules were studied using atomistic simulations. The understanding provided by this modeling effort shall be used towards guiding experiments in better designing these multifunctional hybrids.

DTIC

Composite Materials; Molecular Dynamics; Polymers

20100020304 Southwest Research Inst., San Antonio, TX USA

Blast Pendulum Testing of Milliken Tegris Panels

Grosch, Donald J.; Sagebiel, Erick J.; Eleazer, Hal; January 2008; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-2-0074; Proj-W262387171

Report No.(s): AD-A519689; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Milliken contracted Southwest Research Institute (SwRI) to conduct blast pendulum tests on various panels. The blast pendulum allows one to investigate a material's capability of mitigating sample deformation and bulk structural loading that result from close-in blast loading. The methodology is based upon placing a sample in a semi-rigid frame. The frame is supported by large supports that are free to rotate about a fixed position. Based upon the angular motion, the momentum transferred into the sample can be determined. The pendulum is most useful for looking at plate coatings which hopefully can reduce the plate deformation and the overall momentum transferred into a structure. SwRI conducted a total of four tests on September 5, 2007, using the blast pendulum at its remote site near Yancey, Texas. A representative from Milliken witnessed each test. None of the tests resulted in perforation of the target assembly, and their swing angles and deflections were considerably less than those of a baseline 3/8-inch mild steel target performed the next day (47.2-degree maximum swing with 4.53-inch maximum plate deflection) versus the best Milliken combination that showed a 41.8-degree maximum swing with 2.64-inch maximum plate deflection.

DTIC

Panels; Pendulums; Thermoplasticity

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20100018385 Department of Energy, Washington, DC, USA
Next-Generation Photon Sources for Grand Challenges in Science and Energy
May 2009; 133 pp.; In English; Original contains color illustrations
Report No.(s): DE2009-964403; No Copyright; Avail.: National Technical Information Service (NTIS)

The next generation of sustainable energy technologies will revolve around transformational new materials and chemical processes that convert energy efficiently among photons, electrons, and chemical bonds. New materials that tap sunlight, store electricity, or make fuel from splitting water or recycling carbon dioxide will need to be much smarter and more functional than today's commodity-based energy materials. To control and catalyze chemical reactions or to convert a solar photon to an electron requires coordination of multiple steps, each carried out by customized materials and interfaces with designed nanoscale structures. Such advanced materials are not found in nature the way we find fossil fuels; they must be designed and fabricated to exacting standards, using principles revealed by basic science. Success in this endeavor requires probing, and ultimately controlling, the interactions among photons, electrons, and chemical bonds on their natural length and time scales. NTIS

Energy Conservation; Photons; Planning

20100018466 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3)
Hooker, Stanford B.; VanHeukelem, Laurei; Thomas, Crystal S.; Claustre, Herve; Ras, Josephine; Schluter, Louise; Clementson, Lesley; vanderLinde, Dirk; Eker-Develi, Elif; Berthon, Jean-Francois; Barlow, Ray; Sessions, Heather; Ismail, Hassan; Perl, Jason; December 2009; 108 pp.; In English; See also 20100018467 - 20100018475; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNX09AN94G
Report No.(s): NASA/TM-2009-215849; Copyright; Avail.: CASI: A06, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018466

Seven international laboratories specializing in the determination of marine pigment concentrations using high performance liquid chromatography (HPLC) were intercompared using in situ samples and a mixed pigment sample. The field samples were collected primarily from oligotrophic waters, although mesotrophic and eutrophic waters were also sampled to create a dynamic range in chlorophyll concentration spanning approximately two orders of magnitude (0.020 1.366 mg m^{-3}) The intercomparisons were used to establish the following: a) the uncertainties in quantitating individual pigments and higher-order variables (sums, ratios, and indices); b) the reduction in uncertainties as a result of applying quality assurance (QA) procedures; c) the importance of establishing a properly defined referencing system in the computation of uncertainties; d) the analytical benefits of performance metrics, and e) the utility of a laboratory mix in understanding method performance. In addition, the remote sensing requirements for the in situ determination of total chlorophyll a were investigated to determine whether or not the average uncertainty for this measurement is being satisfied.
Author

Liquid Chromatography; Sea-Viewing Wide Field-of-View Sensor; Chlorophylls; Pigments; Dynamic Range

20100018467 San Diego State Univ., San Diego, CA, USA
The SDSU (CHORS) Method, Chapter 8
Perl, Jason; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 89-97; In English; See also 20100018466; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018467

The CHORS method was developed to provide HPLC phytoplankton pigment analysis support for the NASA MODIS program. The method is a modi ed version of Van Heukelem and Thomas (2001) and uses a reversed-phase C8 column, with a binary solvent gradient. A temperature-controlled autosampler provides continuous sample injection to maintain the quota

of 4,000 samples per year run by CHORS. System calibration is monitored and recorded to ensure repeatability and consistency of data products
Author
Liquid Chromatography; MODIS (Radiometry); Phytoplankton; Pigments; Oceanography

20100018468 DHI Water and Environment, Horsholm, Denmark
The DHI Method, Chapter 3
Schluter, Louis; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 40-42; In English; See also 20100018466; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018468

The HPLC method used at DHI is a somewhat modified version of the HPL method (Van Heukelem and Thomas 2001). In comparison with the DHI method used during SeaHARRE-2 (Wright et al. 1991), the HPL method separates divinyl from monovinyl chlorophyll a, and chlorophyll c1 from chlorophyll c2. Furthermore, the HPL method provided state-of-the-art results during SeaHARRE-2, so the capabilities of the method were as highly rated as possible. When adapted to the DHI HPLC system, the HPL method, however, did not initially provide the same excellent results for the analysis of the SeaHARRE-3 samples, in terms of the precision of the results. Subsequent troubleshooting identified three problems: a) a fault in the autoinjector, b) an inappropriate tetrabutyl ammonium acetate (TbAA) buffer, and c) the HPLC vials were not completely airtight (so there was some evaporation of the extract while it resided in the autosampler compartment). The poor precision was identified prior to submitting the SeaHARRE-3 results by checking the reproducibility of standardized mixed pigments (from DHI Mix-101), which were distributed to all of the participants as part of the intercalibration exercise. This emphasizes the usefulness of such pigment mixtures and the necessity of quality assurance for detecting method problems, which have an impact on the results.
Author
Chlorophylls; Liquid Chromatography; Sea-Viewing Wide Field-of-View Sensor; Oceanography

20100018469 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SeaHARRE-3 Methods, Data, and Analysis, Chapter 1
Hooker, Stanford B.; VanHeukelem, Laurie; Ras, Josephine; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 5-36; In English; See also 20100018466; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018469

The focus of this study was the estimation of uncertainties in quantifying a diverse set of chlorophyll and carotenoid pigment concentrations for a variety of HPLC methods and related procedures used in the analysis of predominantly oligotrophic waters. The results suggest uncertainties are at a minimum in mesotrophic samples and increase as concentrations become larger and smaller, with the largest increase associated with eutrophic samples (confirmed by prior SeaHARRE activities). The chlorophyll a accuracy requirements for ocean color validation activities can be reliably satisfied in predominantly oligotrophic conditions by a quality-assured method. The performance metrics proposed during SeaHARRE-2 were shown to be well conceived, and properly distinguished the methods from one another at a level in keeping with the expected accomplishments of quantitative analysis. Based on the robustness of the performance metrics, it seems warranted to establish performance metrics for the higher-order data products, and proposed thresholds are presented. The higher-order associations in pigments (i.e., sums and ratios) repeatedly confirmed the basic conclusions regarding method performance first established with the individual pigments, and showed that the uncertainties of the individual pigments strongly influence the uncertainty budget for the higher-order variables. There is a significant statistical difference between the results obtained with the C8 and C18 methods with the former outperforming the latter, but the degraded performance of the latter was likely caused by the procedures used by the laboratories involved rather than intrinsic deficiencies with the C18 method being used. The laboratory mix proposed during SeaHARRE-2, and now marketed by DHI, can provide considerable insight into many of the performance aspects of the HPLC method being used.
Author
Carotenoids; Chlorophylls; Liquid Chromatography; Pigments; Sea-Viewing Wide Field-of-View Sensor; Data Processing

20100018470 Commonwealth Scientific and Industrial Research Organization, Hobart, Australia

The CSIRO Method, Chapter 2

Clementson, Lesley; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 37-39; In English; See also 20100018466; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018470

The CSIRO method is a modifed version of the Van Heukelem and Thomas (2001) method. This method has the capability to resolve approximately 35 different pigments with baseline resolution of divinyl and monovinyl chlorophyll a, zeaxanthin and lutein, and partial separation of divinyl and monovinyl chlorophyll b. Samples are extracted over 15-18 h in an acetone solution before analysis by HPLC using a C8 column and binary gradient system, with an elevated column temperature. Pigments are identified by retention time and absorption spectra from a photo-diode array (PDA) detector. The method is regularly validated with the use of both internal and external standards and individual pigment calibration. The detection limit of most pigments is within the range of from 0.001-0.005 mg m(sup -3). The method has been used at CSIRO since August 2004, and has proven to offer a good balance between accuracy of pigment composition and concentration, and the number of samples analyzed. The separation of the divinyl and monovinyl forms of chlorophylls a and b has allowed a complete analysis of samples from the oligotrophic regions of the world ocean.

Author

Pigments; Oceanography; Liquid Chromatography; Solvent Extraction

20100018471 Joint Research Centre of the European Communities, Ispra, Italy

The JRC Method, Chapter 5

VanDer Linde, Dirk; Eker-Develi, Elif; Berthon, Jean-Francois; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 76-79; In English; See also 20100018466; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018471

The HPLC method used at the JRC follows the JGOFS protocols (JGOFS 1994) and is a modified version of the method presented in Wright et al. (1991). It does not allow the separation of divinyl chlorophyll a and b from their respective monovinyl forms. Filters are sonically disrupted, and the pigments are extracted within a 100% acetone solution including an internal standard (trans-beta-apo-8'-carotenal). The HPLC system used includes a quaternary pump, a three-solvent gradient method, a reversed-phase C18 column with an autosampler (both with thermostats), a diode array detector, and a fluorescence detector. The effective limit of detection (computed for the SeaHARRE-3 samples) for the chlorophylls and carotenoids is about 0.0008mg m(sup -3) (for the typical filtration volumes used). In terms of routine sample analysis, this method has been applied almost exclusively to coastal water samples.

Author

Chlorophylls; Coastal Water; Liquid Chromatography; Solvent Extraction; Sea-Viewing Wide Field-of-View Sensor

20100018472 Marine and Coastal Management, Cape Town, South Africa

The MCM Method, Chapter 7

Barlow, Ray; Sessions, Heather; Ismail, Hassan; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 86-88; In English; See also 20100018466; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018472

The MCM method is a reversed-phase HPLC technique using a binary solvent system following a step linear gradient on a C8 chromatography column. Baseline separation of monovinyl and divinyl chlorophylla and of lutein and zeaxanthin, partial separation of monovinyl and divinyl chlorophyll b, and resolution of other key chlorophylls and carotenoids are achieved in an analysis time of approximately 30 min. The use of trans- beta-apo 8'-carotenal as an internal standard improves the accuracy of pigment determinations. Providing a pragmatic balance between good analyte resolution and acceptable sample throughput, the method is suitable for the analysis of a wide range of oceanographic seawater samples.

Author

Liquid Chromatography; Oceanography; Solvents; Water Sampling; Pigments

20100018473 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Prologue

Hooker, et al.; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 1-4; In English; See also 20100018466; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018473

Seven international laboratories specializing in the determination of marine pigment concentrations using high

performance liquid chromatography (HPLC) were intercompared using in situ samples and a mixed pigment sample. The field samples were collected primarily from oligotrophic waters, although mesotrophic and eutrophic waters were also sampled to create a dynamic range in chlorophyll concentration spanning approximately two orders of magnitude (0.020-1.366 mg m(sup -3). The intercomparisons were used to establish the following: a) the uncertainties in quantitating individual pigments and higher-order variables (sums, ratios, and indices); b) the reduction in uncertainties as a result of applying quality assurance (QA) procedures; c) the importance of establishing a properly defined referencing system in the computation of uncertainties; d) the analytical benefits of performance metrics, and e) the utility of a laboratory mix in understanding method performance. In addition, the remote sensing requirements for the in situ determination of total chlorophyll a were investigated to determine whether or not the average uncertainty for this measurement is being satisfied.
Author
Liquid Chromatography; Oceanography; Sea-Viewing Wide Field-of-View Sensor; Chlorophylls; Pigments

20100018474 Maryland Univ., Cambridge, MD, USA
The HPL Method, Chapter 4
VanHeukelem, Laurie; Thomas, Crystal S.; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 43-75; In English; See also 20100018466; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018474

The HPL method was developed for use with a variety of water types. Many pigments important to freshwater, estuarine, and oceanic systems are baseline resolved and quantitatively reported, including divinyl and monovinyl chlorophyll a. The method is based on a C8 HPLC column, a methanol-based reversed-phase gradient solvent system, a simple linear gradient, and an elevated column temperature (60 C). The method can provide quantitative results for up to 25 pigments with qualitative information for additional pigments. Quality assurance measurements are made during sample analysis to confirm that the method performance is within expectations. Investigations into the uncertainties in the method show the 95% confidence limits were estimated as a) 0.5-3.8% for precision of replicate injections within and across sequences, b) 3.2% for chlorophyll a calibration reproducibility, and c) 5.1% for chlorophyll a method precision, including filter extraction and analysis.
Author
Liquid Chromatography; Chlorophylls; Spectrophotometry; Solvent Extraction; Sea-Viewing Wide Field-of-View Sensor; Oceanography; Fresh Water

20100018475 Laboratoire d'Oceanographie de Villfranche, Villefranche-sur-Mer, France
The LOV Method, Chapter 6
Claustre, Herve; Ras, Josephine; The Third SeaWiFS HPLC Analysis Round-Robin Experiment (SeaHARRE-3); December 2009, pp. 80-85; In English; See also 20100018466; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018475

The LOV method is derived from the Van Heukelem and Thomas (2001) technique, and applies a sensitive, reversed-phase HPLC procedure for the determination of chloropigments and carotenoids within 28 min. The different pigments, extracted in 100% methanol, are detected using a diode array detector, which permits automatic pigment identification based on absorption spectra. Optical densities are monitored at 450nm (chloropigments and carotenoids), 667nm (chlorophyll a and derived pigments) and 770nm (bacteriochlorophyll a). The method provides good resolution between most pigments, but uncertainties may arise because of the partial separation of chlorophyll b and divinyl chlorophyll b, and for the resolution of chlorophyll c pigments. It has proven to be efficient over a wide range of trophic conditions, from eutrophic upwelling waters, to the hyperoligotrophic South Pacific subtropical gyre. Short- and long-term quality control is monitored regularly to ensure state-of-the-art analyses. The injection precision of the method is estimated at 0.4%, and the effective limits of quantitation for most pigments are low (0.0004 m gm(sup -3) for chlorophyll a and 0.0007 mg m(sup -3) for carotenoids, for the typical filtration volumes used).
Author
Carotenoids; Liquid Chromatography; Upwelling Water; Chlorophylls; Sea-Viewing Wide Field-of-View Sensor; Oceanography

20100018680 Howard Univ., Washington, DC USA

Polymorphism in Energetic Materials

Deschamps, J R; Parrish, D A; Butcher, R J; Jan 2008; 8 pp.; In English

Report No.(s): AD-A517861; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517861

Polymorphism often occurs in energetic materials. Differences in the forms range from conformational changes in the molecule from one system to another, to conformational equivalents packing in different manners. These differences, whether drastic or subtle, can lead to substantial alterations in stability and performance. The authors recently reported on the crystal structures of five polymorphs of picryl bromide (a common energetic precursor): the previously identified alpha and beta forms, and three new forms, the gamma, delta, and epsilon forms. A new type of interaction has been identified between the nitro groups and pi-electrons of neighboring phenyl rings. Accurate estimation of the properties of new energetic materials can substantially reduce the development cost of new materials by focusing expensive scale-up and testing on only the most promising candidates. The characterization of this new force involved in crystal packing should greatly improve calculations of packing energy and thus improve predictions of explosive yield.

DTIC

Explosives; Polymorphism

20100018700 Sherbrooke Univ., Quebec Canada

The Role of Gold Adatoms and Stereochemistry in Self-Assembly of Methylthiolate on Au(111)

Voznyy, Oleksandr; Dubowski, Jan J; Yates, Jr, J T; Maksymovych, Peter; Apr 2, 2009; 6 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0200

Report No.(s): AD-A517917; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517917

On the basis of high resolution STM images and DFT modeling, we have resolved low- and high-coverage structures of methylthiolate (CH3S) self-assembled on the Au(111) surface. The key new finding is that the building block of all these structures has the same stoichiometry of two thiolate species joined by a gold adatom. The self-arrangement of the methylthiolate-adatom complexes on the surface depends critically on their stereochemical properties. Variations of the latter can produce local ordering of adatom complexes with either (3 x 4) or (3 x 43) periodicity. A possible structural connection between the (3 x 43) structure and commonly observed (3 x 3)R30-deg phase in methylthiolate self-assembled monolayers is developed by taking into account the reduction in the long-range order and stereochemical isomerization at high coverage. We also suggest how the observed self-arrangements of methylthiolate may be related to the c(4 x 2) phase of its longer homologues.

DTIC

Adatoms; Gold; Self Assembly; Stereochemistry

20100018712 Pittsburgh Univ., Pittsburgh, PA USA

Collective Reactivity of Molecular Chains Self-Assembled on a Surface

Maksymovych, Peter; Sorescu, Dan C; Jordan, Kenneth D; Yates, Jr, John T; Dec 12, 2008; 5 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0200

Report No.(s): AD-A517948; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517948

Self-assembly of molecules on surfaces is a route toward not only creating structures, but also engineering chemical reactivity afforded by the intermolecular interactions. Dimethyldisulfide (CH3SSCH3) molecules self-assemble into linear chains on single-crystal gold surfaces. Injecting low-energy electrons into individual molecules in the self-assembled structures with the tip of a scanning tunneling microscope led to a propagating chemical reaction along the molecular chain as sulfur--sulfur bonds were broken and then reformed to produce new CH3SSCH3 molecules. Theoretical and experimental evidence supports a mechanism involving electron attachment followed by dissociation of a CH3SSCH3 molecule and initiation of a chain reaction by one or both of the resulting CH3S intermediates.

DTIC

Chemical Reactions; Electrons; Molecular Chains; Reaction Kinetics; Reactivity; Self Assembly; Sulfides; Surface Reactions

20100018722 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Adsorption and Decomposition of CWA Simulants on Single Crystal and Nanostructured Metal Oxides

Morris, John R; Jan 2009; 16 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0195

Report No.(s): AD-A517975; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517975

Our studies are directed at determining the adsorption mechanisms and reaction pathways for the chemical warfare agent simulant (CWA) for GB (Sarin) on metal oxide surfaces and nanoparticles. By learning about how surface structure, nanoparticle size, composition, and surface co-adsorbates affect the overall interfacial chemistry, we are providing insight that can be applied toward the development of effective sorbent materials for protection and decontamination. Our approach couples ultrahigh vacuum (UHV) surface analysis instrumentation with precision simulant dosing capabilities to explore agent reactivity on highly characterized and contaminant-free metal oxide surfaces. Our work during this funding period has focused on studying the uptake and decomposition of the simulant dimethyl methylphosphonate (DMMP) when it impinges on the surface of nanoparticulate systems.

DTIC

Adsorption; Chemical Reactions; Decomposition; Metal Oxides; Methyl Compounds; Oxides; Radicals; Reaction Kinetics; Single Crystals; Surface Reactions

20100018728 Naval Research Lab., Washington, DC USA

Lifetime Limiting Defects in 4H-SiC

Klein, P B; Shanabrook, B V; Huh, S W; Polyakov, A Y; Skowronski, M; Sumakeris, J J; O'Loughlin, M J; Jan 2008; 3 pp.; In English

Report No.(s): AD-A517986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517986

Efforts are under way to develop electrical power systems for Naval vessels and aircraft to be controlled by small, efficient, and reliable solid-state electronic devices, such as high-power (10 kV) switching diodes. This has provoked significant interest in advancing technology based on 4H-SiC, as this semiconductor is much more capable of withstanding the required high power densities than is Si, which has been the standard material for these applications. Development of these devices requires that the SiC material be of sufficient purity, since defects (alterations from the perfect periodic lattice of Si and C atoms) can trap mobile charge carriers (electrons or holes), thus causing degradation of important electrical properties, such as the average lifetime of the minority carriers. In order to reduce the concentration of these defects (or traps), it is important to determine their chemical structure, so that appropriate strategies may be applied during or after material growth to minimize their incorporation.

DTIC

Charge Carriers; Defects; Half Life; Molecular Structure; Neutron Decay; Silicon Carbides

20100018735 Virginia Univ., Charlottesville, VA USA

Photochemistry on TiO2: Mechanisms Behind the Surface Chemistry

Yates, Jr, John T; Jan 21, 2009; 9 pp.; In English

Contract(s)/Grant(s): W911NF-4-1-0200

Report No.(s): AD-A518004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518004

Photochemistry from TiO2 surfaces is described for two cases: The UV-induced photodesorption of O2 from TiO2(110) - 1 x 1; and the hydrophilic effect caused by UV irradiation on TiO2. In both cases fundamental information about how these processes occur has been found. In the case of the O2 photodesorption kinetics, it has been found that the rate of the process is proportional to the square root of the UV flux, showing that second-order electron?hole pair recombination is dominant in governing the photodesorption rate. In addition these measurements provide an estimate of the concentration of hole traps in the TiO2 crystal. In other measurements of the UV-induced hydrophilicity, starting with the atomically-clean TiO2 surface, it has been shown that the effect occurs suddenly at a critical point during irradiation as a result of photooxidation of a monolayer of hydrocarbon (n-hexane) at equilibrium with ppm concentration of n-hexane in O2 at 1 atmosphere pressure.

DTIC

Chemical Reactions; Photochemical Reactions; Surface Reactions

20100018812 Naval Research Lab., Washington, DC USA

NRL Launches SiC Epitaxial Growth Effort for Future Power Systems

Eddy, Jr, C R; Gaskill, D K; Lew, K K; VanMil, B L; Myers-Ward, R L; Kub, F J; Jan 2007; 8 pp.; In English

Report No.(s): AD-A518208; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518208

The Navy's desire for an all-electric ship will require the creation of new devices with power performance far exceeding existing technologies. Silicon carbide has been identified as the primary candidate semiconductor to build such advanced devices. In January 2006, NRL dedicated a new state-of-the-art SiC epitaxial growth laboratory permitting fundamental research to address current limitations of the material, namely, basal plane dislocations (BPDs) and minority carrier lifetime. Equipped with customized in-situ process diagnostics and an accelerated research plan, the laboratory has already succeeded in growing material with minority carrier lifetimes near world record and is focusing on multiple BPD reduction approaches. This initial success was achieved in part by monitoring the gas phase carbon-to-silicon ratio, the primary variable linked to intrinsic defect levels. Further, a demonstration of mass spectrometer sensitivity of 1014 dopant atoms/cm3 enables the low, controlled doping required by the device technologies.

DTIC

Additives; Electric Generators; Electric Power Plants; Electric Propulsion; Epitaxy; Silicon Carbides; Substrates

20100018826 Naval Research Lab., Washington, DC USA

Transduction of the Spin State Variable Between the Electron and Optical Polarization at Zero Magnetic Field

Hanbicki, A T; van't Erve, O M; Kioseoglou, G; Li, C H; Jonker, B T; Jan 2007; 4 pp.; In English

Report No.(s): AD-A518231; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518231

A New Spin on Electronics: Utilizing the spin degree of freedom of an electron in a semiconductor device is the basis for the emerging field of spin electronics, or spintronics. The idea is that spin-polarized electrons can be introduced into a semiconductor host, and the electron's spin rather than charge can be used as a new state variable to produce performance and functionality not attainable by simply controlling charge motion (as is done in existing devices). To realize this new technology, it is first necessary to get spin-polarized carriers into the semiconductor, and NRL researchers are taking a lead role in this pursuit. Our principal approach has been to electrically inject spin-polarized carriers from an Fe contact into an AlGaAs/GaAs light emitting diode (LED). In this system, we have been able to sustain electron spin polarizations of 40% to 70% in the GaAs. Further, we have uncovered a wealth of information on spin relaxation and transport phenomena through detailed spectroscopic studies. Most recently, we have been able to modify this system so that we can efficiently transduce spin angular momentum from the electrons to the photon optical polarization at zero magnetic field, a key step toward practical device applications such as spin-pumped laser diodes.

DTIC

Aluminum Gallium Arsenides; Gallium Arsenides; Genetics; Magnetic Fields; Optical Polarization; Optical Properties; Particle Spin; Quantum Numbers; Semiconductors (Materials); Transducers; Transferring

20100018907 California Univ., Berkeley, CA USA

Predicting Odor Pleasantness from Odorant Structure: Pleasantness as a Reflection of the Physical World

Khan, Rehan M; Luk, Chung-Hay; Flinker, Adeen; Aggarwal, Amit; Lapid, Hadas; Haddad, Rafi; Sobel, Noam; Nov 1, 2009; 42 pp.; In English

Contract(s)/Grant(s): W911NF-04-1-0321

Report No.(s): AD-A518390; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although it is agreed that physico-chemical features of molecules determine their perceived odor, the rules governing this relationship remain unknown. A significant obstacle to such understanding is the high dimensionality of features describing both percepts and molecules. We applied a statistical method to reduce dimensionality in both odor percepts and physico-chemical descriptors for a large set of molecules. We found that the primary axis of perception was odor pleasantness, and critically, that the primary axis of physico-chemical properties reflected the primary axis of olfactory perception. This allowed us to predict the pleasantness of novel molecules by their physico-chemical properties alone. Olfactory perception is strongly shaped by experience and learning. However, our findings suggest that olfactory pleasantness is also partially innate, corresponding to a natural axis of maximal discriminability amongst biologically relevant molecules.

DTIC

Odors; Olfactory Perception; Predictions

20100018914 Army Research Lab., Aberdeen Proving Ground, MD USA

Molecular Dynamics Simulation of the Kinetic Reaction of Nickel and Aluminum Nanoparticles

Henz, Brian J; Hawa, Takumi; Zachariah, Michael; Mar 2010; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518421; ARL-TR-5134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Molecular dynamics simulations are used to simulate the kinetic reaction of nickel (Ni) and aluminum (Al) particles at the nanometer scale. The effect of particle size on reaction time and temperature for separate nanoparticles is considered as a model system for a powder metallurgy system. Coated nanoparticles in the form of Ni-coated Al nanoparticles and Al-coated Ni nanoparticles are also analyzed as a model for nanoparticles embedded within a matrix. The differences in melting temperature and phase change behavior, e.g., the volumetric expansion of Al between Al and Ni is expected to produce differing results for the coated nanoparticle systems. For instance, the volumetric expansion of Al upon melting is expected to produce large tensile stresses and possibly rupture in the Ni shell for Ni-coated Al. Simulation results showed that the sintering time for separate and coated nanoparticles was nearly linearly dependent upon the number of atoms or volume of the sintering nanoparticles. We also found that nanoparticle size and surface energy was an important factor in determining the adiabatic reaction temperature for both systems at nanoparticle sizes of less than 10 nm in diameter.

DTIC

Aluminum; High Temperature; Molecular Dynamics; Nanoparticles; Nickel; Simulation

20100018921 Army Research Lab., Aberdeen Proving Ground, MD USA

An Overview of Mesoscale Modeling Software for Energetic Materials Research

Larentzos, James; Blaudeau, Jean; Rollett, Anthony D; Chung, Peter W; Mar 2010; 38 pp.; In English

Contract(s)/Grant(s): Proj-BW9825Z2

Report No.(s): AD-A518435; ARL-MR-0737; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Engineering of novel energetic materials requires a thorough understanding of the phenomena that control chemistry, processing, structure, and performance over multiple length and time scales. While atomistic methods are typically limited in time and length scale, and continuum approaches tend to break down at microstructural scales, mesoscale modeling approaches are critical in bridging the gap between the modeling scales. This document serves as an overview of the current state-of-the-art mesoscale modeling software for energetic materials research that is available through commercial or general public licensing.

DTIC

Atmospheric Models; Computer Programs; Explosives; Mesoscale Phenomena; Microstructure

20100018976 Minnesota Univ., Minneapolis, MN USA

Representative Benchmark Suites for Barrier Heights of Diverse Reaction Types and Assessment of Electronic Structure Methods for Thermochemical Kinetics

Zheng, Jingjing; Zhao, Yan; Truhlar, Donald G; Dec 19, 2006; 48 pp.; In English

Report No.(s): AD-A518606; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We propose three small sets of barrier heights for heavy-atom transfer, nucleophilic substitution, and unimolecular and association reactions as benchmarks for comparing and developing theoretical methods. We choose the data sets to be statistically representative subsets of the NHTBH38/04 database. Each data set consists of 6 barrier heights; we call these small benchmark suites HATBH6, NSBH6, and UABH6. Benchmark values are tabulated for 205 combinations of theory level and basis set. The theory levels studied include single-level wave function theory like Hartree-Fork, Moller-Plesset perturbation theory, quadratic configuration interaction, and coupled cluster theory; they also include multicoefficient correlation methods, local and hybrid density functional theory, and semi empirical molecular orbital methods. The three new representative data sets are combined with a previous representative data set for hydrogen-transfer reactions to form a new compact but diverse and representative data set called DBH24. Comparison of a large number of methods for their performance on DBH24 leads us to recommend the following methods for barrier height calculations, or order of decreasing cost: G3SX, BMC-CCSD, PWB6K, BB1K, M06-L, MPW1K, HF/MIDI!, and PM3.

DTIC

Data Bases; Electronic Structure; Height; Kinetics; Nuclear Reactions; Nucleophiles; Quantum Chemistry; Thermochemistry

20100019184 North Dakota State Univ., Fargo, ND USA

Excited-State Absorption of 4'-(5'''-R-PYRIMIDYL)-2,2':6',2''-Terpyridyl Platinum(II) Phenylacetylide Complexes

Haley, Joy E.; Sun, Wenfang; Li, Yungjing; Ji, Zhiqiang; Pritchett, Timothy M; Feb, 2010; 13 pp.; In English; International Symposium on Materials and Devices for Nonlinear Optics, 26 Jun. - 1 Jul. 2009, Porquerolles, France; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-2-0032; Proj-4348

Report No.(s): AD-A517864; AFRL-RX-WP-TP-2010-4039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517864

The singlet excited-state absorption of five 4'-(5'''-R-pyrimidyl)-2,2':6',2/1-terpyridyl platinum(II) phenylacetylide complexes were investigated using fs pump-probe UV-Vis spectroscopy. These complexes exhibit broad, moderately intense S1-Sn absorption from 500 to 800 nm, which could be attributed to the 1MLCT state. The S1-Sn absorption band energy is influenced by the substituent on the 5'''-position of the pyrimidyl ring, with an electron-donating substituent increasing the energy, and electron-withdrawing substituent decreasing it. The singlet excited-state lifetime deduced from the decay of the fs transient absorption is in the range of 37 -139 ps. Open-aperture Z-scan experiments using ns and ps lasers at 532 nm for 1-5 were carried out in CH3CN solutions and the wavelength dispersion characteristics of 1 was investigated using ps laser at various wavelengths. Reverse saturable absorption (RSA) is observed for all complexes at 532 nm for both ns and ps Z scans, and RSA occurs at 500 -600 nm for 1 for ps laser. Fitting of the experimental Z-scan data using a five-level dynamic model gives rise to the quantitative singlet and triplet excited-state absorption cross-sections, which varies from (18 =/- 1)x 10(exp-18) sq cm to (50+/-5)x10(exp-18) sq cm for sigmas and (11+/-1)x10(exp-18) sq cm to (14+/-2)x10(exp-18) sq cm for sigmaT at 532 nm, corresponding to a ratio of 6.5 -29.8 for sigmas/sigmag and 2.8 -11.2 for sigmaT/sigmag for 1-5. Complexes 1, 2 and 4 exhibit a much larger sigmas/sigmag compared to those of 3 and 5. Moreover, the sigmas/sigmag ratio increases from 1.9 at 500 nm to 260 at 600 nm for complex 1.

DTIC

Absorption; Excitation; Phenyls; Platinum; Radicals

20100019205

Chemistry and Physics of Weakly Ionized Plasmas

Viggiano, A A; Morris, Robert A; Decker, Dwight T; Jan. 22, 2010; 23 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A518652; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this task is to make measurements for plasma chemistry over a wide range of temperatures, pressures and other conditions. We have succeeded in pushing the boundaries for conditions in a number of ways. Our ranges of conditions include the highest temperature measurements for both ion molecule and electron molecule reactions. We have made the first measurements of the products of ion - ion recombination, we have found the first four-body electron-ion recombination reaction and discovered a process we call electron catalyzed mutual neutralization. We have also developed techniques to handle excited oxygen, and to study electron attachment to radicals. We have also used what we have learned from the above studies for trace gas detection using chemical ionization mass spectrometry. The summary of the work is below and those interested can look at the list of 131 publications for more specific details.

DTIC

Ionization; Molecules; Plasma Chemistry; Plasmas (Physics)

20100019398 Minnesota Univ., Minneapolis, MN, USA; Argonne National Lab., IL USA

Theoretical Study of Reactions at the Electrode-Electrolyte Interface. Final Report. (8/1/1991-6/30/2006)

Halley, J. W.; June 30, 2006; 9 pp.; In English

Contract(s)/Grant(s): DE-FG02-91ER45455

Report No.(s): DE2010-952604; DOE/ER/45455-1-F; No Copyright; Avail.: Department of Energy Information Bridge

In this project, reaction rates were predicted by numerical methods, in a collaboration with Argonne National Laboratory . Emphasis is on electron transfer and transport involving ions known to be important in enhancing stress corrosion cracking in light water reactors and on electron transfer at oxide surfaces. In the latter part of the grant period we placed increased emphasis on development and use of self consistent tight binding methods for this kind of study. We showed that by careful fitting of results from first principles plane wave calculations, we could model surfaces and interfaces oxides and metals using these methods. We obtained results for the titanium/titanium oxide interface in this way and completed a model of the ruthenium dioxide surface using our innovative self consistent tight binding molecular dynamics methods. We completed

development of a description of liquid water within the self consistent tight binding context and studied the rutile water 110 interface to determine if it is hydroxylated. A self consistent tight binding study of titanium metal surfaces demonstrated the usefulness of this method for metals. In collaboration with the Argonne group, we extended the tight binding calculations on rutile titania to the anatase form and made the first calculations of the relative stability of anatase and rutile as a function of crystallite size. We completed studies of small anatase particles in water using the method and found significant distortions of nanoparticle crystallite shapes as a consequence of interactions with the water.
NTIS
Electrodes; Electrolytes; Reaction Kinetics; Numerical Analysis; Light Water Reactors

20100019421 OptiMetrics, Inc., Ann Arbor, MI USA
Initial High-Power-CW-Laser Testing of Liquid-Crystal Optical Phased Arrays
Whitaker, Bert; Harris, Scott; February 2010; 40 pp.; In English
Contract(s)/Grant(s): Proj-2003; 62204F
Report No.(s): AD-A518054; AFRL-RY-WP-TR-2010-1043; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518054

The performance of liquid-crystal phase retarders and optical phased arrays may be gauged by examining their behavior when they are used as variable wave plates. We used this method to evaluate the performance of these devices as they are heated, and as they are exposed to high-power laser energy at 1.083 micrometer. The results indicate that at higher temperatures or higher power levels of laser exposure, the available phase-modulation depth is reduced, presumably due to heating in both cases. In some instances, normal phase-shifting behavior returned when the conditions of the tests were removed, while in others, the behavior eventually vanished entirely, never to return on its own. We developed a novel method for reviving (as well as extending the temperature range of) the performance of phase retarders after such impairments, by imposing a momentary, DC drive voltage (the DC Reset). Also, as the high-power laser was activated (or deactivated), the LCoS (Liquid Crystal on Silicon) OPA's we examined exhibited thermal time constants in the neighborhood of 20 seconds. Petrographic-microscope images were recorded before and after the tests and, in spite of no apparent materials damage, showed LC migration in most of the devices, supposably due to thermal expansion and contraction. Additional petrographic images were recorded to show the visually apparent local phase-shifting behavior of the devices as the laser-energy level was increased.
DTIC
Continuous Wave Lasers; High Power Lasers; Liquid Crystals; Phased Arrays

20100019526 Minnesota Univ., Minneapolis, MN, USA
Electrochemistry of Nanostructured Intercalation Hosts
Smyrl, W. H.; Mar. 2009; 9 pp.; In English
Contract(s)/Grant(s): FG02-01ER15221
Report No.(s): DE2010-948842; DOE/ER-15221; No Copyright; Avail.: Department of Energy Information Bridge

We have shown that: Li+ ions are inserted reversibly, without diffusion control, up to the level of at least 4 moles Li+ ions per mole for V2O5, in the aerogel (ARG) form (500 m2/g specific surface area) and aerogel-like (ARG-L) form (200 m2/g specific surface area); polyvalent cations (Al+3, Mg+2, Zn+2) may be intercalated reversibly into V2O5 (ARG) with high capacity (approaching 4 equivalents/mole V2O5 (ARG)) for each; dopant cations such as Ag+ and Cu+2 increase the conductivity of V2O5 (XRG) up to three orders of magnitude, they are electrochemically active - showing reduction to the metallic-state in parallel to intercalation of Li+ ions - but are not released to the electrolyte upon oxidation and Li+ ion release (Cu+2 ions are reduced to Cu metal and reoxidized to Cu+2 in Li+ ion insertion/release cycles, but the copper ions are not released to the electrolyte over more than 400 cycles of the XRG form); we have shown that Cu+2 ion (dopant) and Zn+2 ions (chemical insertion and dopant) occupy the same intercalation site inV2O5 xerogel and aerogel; the reversible intercalation of Zn+2, Mg+2, and Al+3 in the ARG(11) indicates that these cations are 'mobile', but that Cu+2 ions and Ag+ ions are 'immobile' in the xerogel, i.e., the latter ions are not exchanged with the electrolyte in Li+ ion intercalation cycling.
NTIS
Electrochemistry; Intercalation

20100019528 Minnesota Univ., Minneapolis, MN, USA
Microstructural Evolution and Interfacial Motion in Systems with Diffusion Barriers
Leoall, P. H.; Mar. 2009; 5 pp.; In English
Contract(s)/Grant(s): DE-FG02-9ER4570
Report No.(s): DE2010-948729; No Copyright; Avail.: Department of Energy Information Bridge

This research program was designed to model and simulate phase transformations in systems containing diffusion barriers. The modeling work included mass flow, phase formation, and microstructural evolution in interdiffusing systems. Simulation work was done by developing Cahn-Hilliard and phase field equations governing both the temporal and spatial evolution of the composition and deformation fields and other important phase variables.
NTIS
Diffusion; Microstructure; Phase Transformations

20100019531 Michigan State Univ., East Lansing, MI, USA; Lawrence Livermore National Lab., Livermore, CA USA; Oak Ridge National Lab., TN USA; Fermi National Accelerator Lab., Batavia, IL, USA
Measuring Radiation Damage from Heavy Energetic Ions in Aluminum
Kostin, M.; Ronningen, R.; Ahle, L.; Mansur, L.; Mokhov, N.; Feb. 2009; 38 pp.; In English
Contract(s)/Grant(s): DE-FG02-07ER41472
Report No.(s): DE2010-948044; No Copyright; Avail.: National Technical Information Service (NTIS)

An intense beam of 122 MeV/u (9.3 GeV) 76Ge ions was stopped in aluminum samples at the Coupled Cyclotron Facility at NSCL, MSU. Attempts were made at ORNL to measure changes in material properties by measuring changes in electrical resistivity and microhardness, and by transmission electron microscopy characterization, for defect density caused by radiation damage, as a function of depth and integrated ion flux. These measurements are relevant for estimating damage to components at a rare isotope beam facility.
NTIS
Aluminum; Cyclotrons; Heavy Ions; Ion Beams; Radiation Damage

20100019546 University of Southern California, Los Angeles, CA USA
Photoinitiated Processes in Small Hydrides
Wittig, C.; May 14, 2009; 7 pp.; In English
Contract(s)/Grant(s): FG02-04ER15509
Report No.(s): DE2010-952390; DOE/ER/15509-1; No Copyright; Avail.: Department of Energy Information Bridge

Areas and topics that received the most focused attention are identified in the report. Our main contributions and how they relate to the field of chemical dynamics, in general, are organized according to these groups. Publications are listed but not explained per se, as this would produce a manifestly unreadable document. They are all available in PDF format upon request. Following this, brief synopses are presented for each of the groupings - getting straight to the point, but with the wisdom of hindsight.
NTIS
Hydrides; Photochemical Reactions

20100019687 Auburn Univ., AL USA
Evaluation of the Effects of Hydrogen Peroxide on Common Aviation Structural Materials
Chou, S F; Sk, M H; Sofyan, N I; Overfelt, R A; Gale, W F; Gale, H S; Shannon, C G; Fergus, J W; Watson, J; Dec 2009; 21 pp.; In English
Report No.(s): AD-A518976; DOT-FAA-AM-09-23; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518976

Infected passengers can unintentionally contaminate the interior of aircraft; deliberate biological contamination from criminals and international adversaries is also possible. Previous work has provided information regarding the delivery mechanism and capability of STERIS Corporation's Vaporized Hydrogen Peroxide (VHP*) technology as a decontaminant/disinfectant/sanitizer for transportation vehicles like aircraft, buses, subway trains, ambulances, etc. The present report documents a materials compatibility evaluation of the effects of hydrogen peroxide exposure on the physical and mechanical properties of the following commercial grade structural materials: 2024-T351, 2024-T6 and 7075-T6 aluminum, 304 stainless steel, carbon fiber/epoxy composites and glass fiber/epoxy composites, including FR4 laminate materials widely used for printed circuit boards. Measurements of changes in sample weights due to absorption, oxidation, or corrosion were made as

were evaluations of changes in tensile and flexural mechanical properties. The tensile properties of samples of the metallic samples were unaffected by exposures to either vapor phase or 35% liquid phase hydrogen peroxide. In addition, the carbon fiber/epoxy, glass fiber/carbon fiber epoxy, and the FR4 printed circuit board materials exhibited no significant changes in flexural strength or strain at peak load after 10 VHP exposures. However, some mechanical degradation in the composite samples was observed after 168 hour exposure to 35% liquid hydrogen peroxide. It is recommended that condensation be avoided during application of vapor phase hydrogen peroxide. *VHP is a registered trademark of the STERIS Corporation, Mentor, OH.
DTIC
Aluminum Alloys; Compatibility; Epoxy Matrix Composites; Hydrogen Peroxide

20100019711 Chicago Univ., Chicago, IL USA
Modifying Metal-Polymer Nanostructures Using UV Exposure
Yufa, Nataliya; Fronk, Stephanie; Darling, Seth B; Divan, Ralu; Lopes, W; Sibener, S J; Mar 2, 2009; 5 pp.; In English
Report No.(s): AD-A519016; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519016

Metals have a variety of behaviors when deposited onto diblock copolymer films, in particular, poly(styrene-b-methylmethacrylate). Silver is known to form nanowires, whereas gold forms ellipsoidal nanoparticles of different sizes on each of the blocks, and chromium creates a uniform film on PS-b-PMMA. We show that with UV light we can alter the separation between silver nanowires, by making each wire narrower. We also demonstrate the effects of UV light on PS-b-PMMA coated with thin layers of gold and chromium, as observed with atomic force microscopy and transmission electron microscopy. We have found that UV exposure increased corrugation of such metal-polymer hybrids by removing PMMA domains, but did not remove metal residing on top of those domains. The ability to manipulate the morphology of these nanomaterials has potential application in areas such as electronics and sensor technology.
DTIC
Exposure; Metals; Nanostructures (Devices); Polymers; Ultraviolet Radiation

20100019719 Princeton Univ., NJ USA
Droplet and Supercritical Flame Dynamics in Propulsion
Law, Chung K; Mar 26, 2010; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-0094
Report No.(s): AD-A519038; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519038

The present program is concerned with the dynamics of droplet collision and flame-flow interaction that are of relevance to liquid-fueled turbulent combustion in high-pressure propulsive devices. The investigation during the reporting period involved six projects, namely: (1) Formulation of a comprehensive theory of the dynamics of binary droplet collision, especially in predicting the experimentally observed bouncing and coalescence phenomena; (2) Computational investigation of the gasification mechanism of multicomponent droplets, demonstrating that at elevated pressures the influence of liquid-phase mass diffusion is weakened; (3) A comprehensive study on the influence of elevated pressure on chemical kinetics; (4) Formulation of a theory of acoustic-flame resonance; (5) transition to detonation of an accelerating expanding flame; (6) computational simulation of the flame stabilization in a nozzle-generated flow.
DTIC
Drops (Liquids); Flame Propagation; Flames; Fuels; Propulsion; Stability; Van Der Waals Forces

20100019720 Clemson Univ., SC USA
Basic Studies in Microwave Sciences
Wang, Pingshan; Song, Chunrong; Zhang, Hanqiao; Geng, Yongtao; Zou, Huan; Mar 22, 2010; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-0505
Report No.(s): AD-A519040; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519040

This project studies (i) DI water properties under high-electric field stress, and (ii) CMOS circuits to capture and analyze short electrical pulses. For the first task, microwave microfluidic channels are fabricated with 260 nm channel heights. DC voltages up to 38 V are applied to DI water with its dielectric permittivity measured up to 16 GHz. Significant water

permittivity reduction is observed when the applied field is 1 MV/cm. A new technique is proposed and demonstrated for sub-10 nm planar nanofluidic channel fabrication. For the second task, a CMOS transmission line based pulse capture and analysis circuit is proposed and analyzed. CMOS meander lines, which are used for spatial signal sampling, are tested and modeled. CMOS transmission-line based pulse generators are also studied and tested. This project supported 1 Ph. D. student, who are scheduled to graduate next year, and 1 MS student, who are scheduled to graduate in December. From the work in this project, 3 peer-reviewed journal papers have been published with 2 journal submissions under revision and 1 journal submissions under preparation. This work also produced two peer-reviewed conference publications with two abstracts accepted for presentations. Additionally, two provisional patent applications have been filed. Due to the results from the planar nanofluidic channel work in this project, NSF is currently supporting further research in this direction.
DTIC
Deionization; Microwave Transmission; Microwaves

20100019736 Illinois Univ., Urbana-Champaign, IL USA
Analysis of Multi-Scale Phenomena and Transients in Explosives and Complex Energetic Systems
Stewart, D S; Soo, Shao L; Apr 8, 2010; 9 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0044
Report No.(s): AD-A519093; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519093

This report summarizes the activities of a 3-year grant and 6 month extension supported by the Air Force Office of Scientific Research. The main topics covered by our investigations, are described succinctly as: (1) Complexity and meso-scale investigations of condensed explosive and reactive materials that include dynamical interaction of reactive flow at the scale of the microstructure of the material. We developed concepts related to the multi-scale statistical design of high energy density materials and specific modeling approaches required to described metal loaded, condensed phase explosives, with a reduced detonation theories. (2) Theory and simulation for porous energetic explosives and multiphase reactive materials. This included asymptotic derivation of a theory of detonation shock dynamics for a porous energetic materials, and the development of entirely new models that can be used to describe non-classical detonation phenomena observed in reactive materials (sometime referred to as 'solid state detonation'.) (3) Linear and nonlinear theory for stability of detonations, formulated in the shock attached frame. The grant also supported the completion of two comprehensive review articles on detonation stability theory and detonation shock dynamics.
DTIC
Complex Systems; Explosives

20100019760 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Effects of Hydrogen Pretreatment on Physical-Vapor-Deposited Nickel Catalyst for Multi-Walled Carbon Nanotube Growth
Crossley, Benjamin L; Kossler, Mauricio; Coutu, Jr, Ronald A; Starman, LaVern A; Collins, Peter J; Feb 17, 2010; 8 pp.; In English
Report No.(s): AD-A519169; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519169

Physical vapor deposited nickel catalyst layers of 10, 50, 100, 200, 350, and 500 angstrom were granulated using hydrogen plasma for varying times to determine an effective carbon nanotube (CNT) growth process using microwave plasma enhanced CVD (MPECVD). Nickel was deposited via sputtering or evaporation. The catalyst granule size, density, and resulting CNTs were analyzed. Sputtered nickel of 50 angstrom with 5 minutes of hydrogen plasma pretreatment resulted in the most effective CNT growth.
DTIC
Carbon Nanotubes; Catalysts; Hydrogen; Nanostructure Growth; Nickel; Pretreatment; Vapor Deposition

20100019761 Naval Academy, Annapolis, MD USA
High-Extinction Ruthenium Compounds for Sunlight Harvesting and Hole Transport
Staniszewski, Aaron; Heuer, William B; Meyer, Gerald J; Jan 29, 2008; 4 pp.; In English
Report No.(s): AD-A519170; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519170

The compounds Ru(bpy)2(BTL)(PF6)2 and Ru(deeb)2(BTL)(PF6)2, where bpy is 2,2(prime)-bipyridine, deeb is

4,4(prime)-(C2H5CO2)2-bpy, and BTL is 9(prime)-[4,5-bis(cyanoethylthio)]-1,3-dithiol-2-ylidene]-4(prime),5(prime)-diazafluorene, were found to have very high extinction coefficients in the visible region. In an acetonitrile solution, the extinction of Ru(deeb)2(BTL)(PF6)2 was epsilon = 44 000 plus/minus 1000 M(exp -1) cm(exp)-1 at lambda = 470 nm. Two quasi-reversible oxidation waves, E(sub 1/2) = +0.88 and +1.16 V, and an irreversible reduction, E(sub pr) = -1.6 V, were observed versus ferrocene (Fc(exp +/0)). At -40 degrees Celsius, a state was observed with spectroscopic properties characteristic of a metal-to-ligand charge-transfer excited state, tau = 25 ns. This same compound was found to photoinject electrons into TiO2 with a quantum yield phi = 0.3 plus/minus 0.2 for 532.5 or 417 nm light excitation in a 0.1 M LiClO4/acetonitrile electrolyte. In regenerative solar cells, a sustained photocurrent was observed with a maximum incident photon-to-current efficiency of 0.4. The photocurrent action and absorptance spectra were in good agreement, consistent with injection from a single excited state.
DTIC
Acetonitrile; Extinction; Ligands; Osmium Compounds; Photoelectricity; Pyridines; Ruthenium Compounds; Solar Cells; Sunlight

20100019786 IAP Research, Inc., Dayton, OH USA
SiC Material Properties Processed Via Dynamic Compaction With Pressureless Sintering
Chelluri, B; Knoth, E A; Schumaker, E J; Barber, J P; Franks, L P; Jan 22, 2007; 19 pp.; In English
Report No.(s): AD-A519242; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519242
The project goals of this effort are to design and build a subscale dynamic magnetic compaction (DMC) system to produce a near net shape flat armor tiles; to scale up the system to make larger armor tiles; to pressureless sinter silicon carbide tiles to full density; and ballistic test tiles and populate an array with tiles.
DTIC
Armor; Compacting; Silicon Carbides; Sintering; Tiles

20100019871 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optical Properties of Si, Ge, GaAs, GaSb, InAs, and InP at Elevated Temperatures
Harris, Thomas R; Mar 2010; 75 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519309; AFIT/GAP/ENP/10-M08; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Investigation of the optical and electrical behavior of some semiconductors at very high temperatures has not been an area of much study, at least not experimentally. The importance of such research becomes obvious due to the effects of high temperatures on semiconductor devices such as infrared detectors and light emitters. Besides the destructive effects of thermal stress and melting, changes in the optical properties of the material can greatly affect device performance. In this research, the infrared absorption of Si, Ge, GaAs, GaSb, InAs, and InP was measured from 0.6 to 25 micrometers at temperatures ranging from 295 up to 900 K, using a Fourier Transform InfraRed (FTIR) spectrometer in combination with a custom-designed heater assembly. The band gap shift was estimated from the experimental results and compared to existing data. There was good agreement between the two results. For GaSb and InAs, data was taken at higher temperatures than what was found in the literature. That data provides an extension of existing theory to a higher temperature range. Free-carrier absorption was also observed and was compared to existing data. Temperature dependent expressions were developed for the band gap energy and free-carrier absorption in Si, Ge, GaAs, GaSb, InAs, and InP.
DTIC
Electrical Properties; Gallium Antimonides; Gallium Arsenides; Germanium; High Temperature; Indium Arsenides; Indium Phosphides; Optical Properties; Semiconductor Devices; Silicon

20100019881 Texas Univ., Austin, TX USA
Testing of Aerosol Sampler to Remove Radon and Thoron Progeny Interference from Aerosol Samples for Nuclear Explosion Monitoring
Biegalski, Steven R; Weaver, Christopher J; Waye, Scot; Ezekoye, Ofodike A; Hopke, Phillip K; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-1-0016
Report No.(s): AD-A519366; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Studies show that aerosols with natural activity have an aerodynamics diameter in the range of 0.1 to 1.0 micrometer. In

contrast, atmospheric nuclear explosions produce radioactive aerosols with aerodynamic diameters of less than 0.1 micrometer. Surface nuclear explosions produce a bimodal distribution of radioactive aerosol particles with aerodynamic particles greater than 1.0 micrometer and less than 0.1 micrometer. A high-volume (70 m(3)h(-1)), low-pressure aerosol impactor has been developed that separates the particles into the three size distributions: aerosols with aerodynamic diameters greater than 1.0 micrometer, between 0.1 and 1.0 micrometer, and smaller than 0.1 micrometer. This sampler has been tested and compared to the performance of a micro-orifice uniform deposit impactor (MOUDI). Testing was completed by measuring natural aerosol samples as well as testing with a submicrometer monodisperse aerosol generation system. Additional pressure taps have been included in the system to improve system characterization. As a result of the testing and measurements, design modifications are being made for system optimization.
DTIC
Aerosols; Air Sampling; Deposits; Impactors; Nuclear Explosions; Orifices; Progeny; Radon; Radon Isotopes; Samplers

20100019892 California Univ., Berkeley, CA USA
Absence of Amorphous Phase in High Power Femtosecond Laser-Ablated Silicon
Rogers, Matthew S; Grigoropoulos, Costas P; Minor, Andrew M; Mao, Samual S; Jan 2009; 4 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446; AC02-05CH11231
Report No.(s): AD-A519387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As femtosecond lasers emerge as viable tools for advanced microscale materials processing, it becomes increasingly important to understand the characteristics of materials resulting from femtosecond laser microablation or micromachining. We conducted transmission electron microscopy experiments to investigate crater structures in silicon produced by repetitive high power femtosecond laser ablation. Comparable experiments of nanosecond laser ablation of silicon were also performed. We found that an amorphous silicon layer that is typically produced in nanosecond laser ablation is absent when the material is irradiated by high power femtosecond laser pulses. Instead, only a defective single crystalline layer was observed in the high power femtosecond laser-ablated silicon crater. Possible mechanisms underlying the formation of the defective single crystalline phase are discussed.
DTIC
Ablation; Amorphous Materials; High Power Lasers; Pulsed Lasers; Silicon

20100019895 Army Research Lab., Adelphi, MD USA
Results of Bare Die Probing for RF Booster Chip at 450, 915, and 2400 MHz
Mitchell, Gregory; Penn, John; Apr 2010; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519397; ARL-TR-5170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Low-power radio frequency (RF) transceivers have been used for low-cost, high volume commercial applications that do not always meet the needs of critical Army systems. In low-power applications, a tradeoff between transmit range and battery life exists. A simple means of extending transmit range would be to add a custom integrated circuit (IC) between the transceiver and antenna. Using appropriate technologies, a tradeoff in size, efficiency, and performance is achievable. We present a custom design using gallium arsenide (GaAs) technology to provide enhanced performance. This design optimizes the output power, noise figure, power added efficiency, insertion loss, and range performance of an overall low-power RF system.
DTIC
Chips; Gallium Arsenides; Radio Frequencies

20100019913 Naval Academy, Annapolis, MD USA
Nonlinear Interactions of Light with Liquid Crystals
Minut, Aurelia; Jan 2007; 8 pp.; In English
Report No.(s): AD-A519445; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Crystals are solids in which the molecules are arranged in clearly defined 3D patterns. Liquid crystals are substances whose constituent molecules retain the spatial regularity of solid crystals, but, at the same time, have the freedom of motion of molecules of a conventional liquid. Common usage of liquid crystals includes household appliances such as microwave ovens, CD players, or thermometers and even wrist watches, but they have an increasingly visible application as the main component in LCD monitors. In fact, the acronym LCD stands for liquid crystal display. Liquid crystals can be classified by the type of directional and positional ordering of the constituent molecules into several categories (phases), of which the most common is the nematic phase. This is the type used in LCD monitors, and is the object of our study. The molecules of a

nematic liquid crystal have a cylindrical shape, and can move randomly. Having one axis longer than the other two, it makes sense to talk about orientation of these molecules, which can be modeled mathematically by a unit vector field called director. The one defining property of nematics is that in the absence of external factors such as electro-magnetic fields, or temperature fluctuations, the director is roughly spatially invariant.
DTIC
Liquid Crystals; Nonlinear Systems; Nonlinearity

20100019929 Princeton Univ., NJ USA
Physical and Chemical Processes in Flames
Law, Chung K; Feb 15, 2010; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-07-1-0052; Proj-2308
Report No.(s): AD-A519476; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The scope of the present program covers the structure and response of laminar and turbulent premixed and diffusion flames, with emphases on effects of high pressure, flame/flow unsteadiness, and chemistry. Studies on combustion chemistry included: (1) experimental determination of stretch-affected ignition and extinction limits of premixed and nonpremixed flames and the laminar flame speeds for various fuel-oxidizers including CO/H2, ethylene, 1,3-butadiene, n-heptane, and methyl decanoate; (2) further advances on the method of directed relation graph for mechanism reduction, and auxiliary methodologies for facilitated computation including analytic solution of the quasi-steady species, the lumping of diffusion coefficients, and the development of a fitting formula for the falloff curves of unimolecular reactions; and (3) soot formation in flames through mapping of the toluene flame structure and direct numerical simulations of the turbulent premixed and diffusion flame structure. Studies on flame dynamics show strong coupling between intrinsic flamefront pulsating instability, radiation heat loss, flame stretch, and the extinction limits for diffusion flames, with and without forcing. These accomplishments are expected to be useful to the general interests of AFOSR in the fundamental and practical issues of flame dynamics, chemical kinetics, turbulent combustion, soot formation, radiative hear transfer, flame extinction, and stabilization.
DTIC
Chemical Properties; Chemical Reactions; Flames

20100019942 University of Central Florida, Orlando, FL USA
Stand-Off Detection of Organic Samples Using Filament-Induced Breakdown Spectroscopy
Martin, James; Baudelet, Matthieu; Weidman, Matthew; Fisher, Matthew K; Bridge, Candice; Brown, Christopher G; Sigman, Michael; Dagdigian, Paul J; Richardson, Martin; Jan 2009; 8 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446
Report No.(s): AD-A519503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As an alternative to focusing nanosecond pulses for stand-off LIBS detection of energetic materials, we use self-channeled femtosecond pulses from a Ti:Sapphire laser to produce filaments at 12 meters and create a plasma on copper, graphite and polyisobutylene film. We show the possibilities of this Laser-Induced Breakdown Spectroscopy configuration for thin organic sample detection on a surface at a distance.
DTIC
Laser-Induced Breakdown Spectroscopy; Organic Materials; Spectroscopy

20100020002 Georgia Inst. of Tech., Atlanta, GA USA
Polyacrylonitrile/Carbon Nanotube Composite: Precursor for Next Generation Carbon Fiber
Feb 23, 2010; 107 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0233
Report No.(s): AD-A519646; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the preliminary study it was reported that gel spun polyacrylonitrile (PAN) and PAN/single wall carbon nanotube (SWNT) composite fibers have been stabilized in air and subsequently carbonized in argon at 1100 C. Differential scanning calorimetry (DSC) and infrared spectroscopy suggested that the presence of single wall carbon nanotube affects PAN stabilization. Carbonized PAN/SWNT fibers exhibited 10 to 30 nm diameter fibrils embedded in brittle carbon matrix, while the control PAN carbonized under the same conditions exhibited brittle fracture with no fibrils. High resolution transmission electron microscopy and Raman spectroscopy suggests the existence of well developed graphitic regions in carbonized PAN/SWNT and mostly disordered carbon in carbonized PAN. Tensile modulus and strength of the carbonized fibers were as high as 250 N/tex and 1.8 N/tex for the composite fibers and 168 N/tex and 1.1 N/tex for the control PAN based carbon fibers,

respectively. The addition of 1 wt% carbon nanotubes enhanced the carbon fiber modulus by 49% and strength by 64%. Carbon fiber diameter in this study was above 5 micrometer. In a follow up study, polyacrylonitrile (PAN) and PAN/carbon nanotube (CNT) composite (99/1) based carbon fibers with an effective diameter of about 1 micrometer have been processed using island-in-a-sea bi-component cross-sectional geometry and gel spinning. PAN/CNT (99/1) based carbon fibers processed using this approach exhibited a tensile strength of 4.5 GPa (2.5 N/tex) and tensile modulus of 463 GPa (257 N/tex), while these values for the control PAN-based carbon fiber processed under the similar conditions were 3.2 GPa (1.8 N/tex) and 337 GPa (187 N/tex), respectively. Properties of these 1 micrometer diameter carbon fibers have been compared to the properties of the larger diameter (6 micrometers) PAN and PAN/CNT based carbon fibers.
DTIC
Brittleness; Carbon Fibers; Carbon Nanotubes; Heat Measurement; Infrared Spectroscopy; Polyacrylonitrile; Walls

20100020004 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Nitrogen and Phosphorus Biomass-Kinetic Model for Chlorella vulgaris in a Biofuel Production Scheme
Rowley, William M; Mar 2010; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519649; AFIT/GES/ENV/10-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Chlorella vulgaris was cultured in microbioreactors using Bold's Basal medium at varying nitrogen and phosphorus concentrations to define nitrogen and phosphorus utilization standards. Nutrient concentration was varied between 137 mg/L to 7.33 mg/L NO3-N and between 55.2 mg/L to 11.0 mg/L PO4-P in five test scenarios. All were grown under a constant photoperiod at 22 +/-2 degree and a mixture of 4 to 10% carbon dioxide/air. Maximum yield and growth rate occurred with the highest initial nitrogen and phosphorus concentrations. A statistically significant difference in biomass was found among all test levels at the end of the eight day growth period. Applying both Liebig's Law of the Minimum and the Blackman Limitation, it was determined that nitrogen was the limiting factor over the range of concentrations tested. Michaelis-Menten biokinetic coefficients (k), the reaction rate constant; the half saturation constant (Km); and Yx, the yield coefficients were also determined. To maximize C. vulgaris growth initial N concentration values should be 137 mg/L and should not be allowed to fall below 69 mg/L. No equivalent recommendation for P was determined. Yield coefficient calculations suggested that the N:P ratio should be at least 3:1. This study was conducted as a part of the ongoing advanced jet fuel project at the University of Dayton Research Institute and a part of the military objective to reduce the carbon footprint of jet fuel production.
DTIC
Biomass; Chlorella; Fuels; Jet Engine Fuels; Nitrogen; Phosphorus

20100020231 Illinois Univ., Urbana, IL USA
Chemomechanics with Molecular Force Probes
Huang, Zhen; Boulatov, Roman; Mar 30, 2010; 23 pp.; In English
Contract(s)/Grant(s): FA9550-08-1-0072
Report No.(s): AD-A519273; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519273

Chemomechanics is an emerging area at the interface of chemistry, materials science, physics, and biology that aims at quantitative understanding of reaction dynamics in multiscale phenomena. These are characterized by correlated directional motion at multiple length scales-from molecular to macroscopic. Examples include reactions in stressed materials, in shear flows, and at propagating interfaces, the operation of motor proteins, ion pumps, and actuating polymers, and mechanosensing. To explain the up to 10(15)-fold variations in reaction rates in multiscale phenomena-which are incompatible within the standard models of chemical kinetics-chemomechanics relies on the concept of molecular restoring force. Molecular force probes are inert molecules that allow incremental variations in restoring forces of diverse reactive moieties over hundreds of piconewtons (pN). Extending beyond the classical studies of reactions of strained molecules, molecular force probes enable experimental explorations of how reaction rates and restoring forces are related. In this review, we will describe the utility of one such probe-stiff stilbene. Various reactive moieties were incorporated in inert linkers that constrained stiff stilbene to highly strained macrocycles. Such series provided the first direct experimental validation of the most popular chemomechanical model, demonstrated its predictive capabilities, and illustrated the diversity of relationships between reaction rates and forces.
DTIC
Chemical Analysis; Molecular Properties; Chemical Reactions; Reaction Kinetics; Proteins

20100020277 Air Force Research Lab., Wright-Patterson AFB, OH USA; University of North Texas, Denton, TX, USA
Processing and Thermal Conductivity of Carbon Nanotube-Reinforced Nickel Matrix Composites (Preprint)
Tiley, J.; Hwang, J. Y.; Singh, A. R.; Banerjee, R.; Choi, T. Y.; Proceedings of the 2009 ASME Summer Heat Transfer Conference; January 2010; 6 pp.; In English; 2009 ASME Summer Heat Transfer Conference, 19-23 Jul. 2009, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): Proj-4347; 62102F
Report No.(s): AD-A519661; AFRL-RX-WP-TP-2010-4050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multi-wall carbon nanotube (MWCNT)-reinforced nickel composites have been manufactured in a bulk form by using a laser deposition technique, commercially known as the laser engineered net shaping (LENS(Trademark)) process. These nanocomposites have been characterized in detail by using scanning electron microscopy (SEM) and transmission electron microscopy (TEM), and high-resolution TEM study has also been conducted on these nanocomposites to characterize the nanotube/metal matrix interface. In addition, the thermal conductivities of Ni/CNT composites deposited by the LENS(Trademark) process have been measured by using Fourier Law of conduction in vacuum. The measurement did not show enhancement of thermal properties, which is caused by the inherent formation of voids and carbide formed during the LENS(Trademark) process.
DTIC
Carbon Nanotubes; Composite Materials; Lasers; Metal Matrix Composites; Nickel; Thermal Conductivity

20100020287 Air Force Research Lab., Rome, NY USA
Morphology, Microstructure and Transport Properties of ZnO Decorated SiO2 Nanoparticles (Preprint)
Van Nostrand, Joseph E.; Cortez, Rebecca; Rice, Zachary P.; Cady, Nathaniel C.; Bergkvist, Magnus; April 15, 2010; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NSF EEC-0824341; Proj-459T
Report No.(s): AD-A519629; AFRL-RI-RS-TP-2010-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on a novel, surfactant free method to achieve nanocrystalline ZnO decoration of an SiO2 nanoparticle at ambient temperature. The size distribution of the naked and decorated SiO2 nanoparticles is measured by dynamic light scattering, and monodisperse distribution is observed for each. The morphology and microstructure of the nanoparticles are explored using atomic force microscopy and high resolution transmission electron microscopy. Investigation of the optical properties of the ZnO decorated SiO2 nanoparticles shows absorption of 350 nm. This blue shift in absorption compared to bulk ZnO nanocrystals. Finally, the electronic transport properties of the nanoparticles is explored by scanning conductance atomic force microscopy. A memristive hysteresis in the transport properties of the individual ZnO decorated SiO2 nanoparticles is observed. Optical absorption measurements suggest the presence of oxygen vacancies, the migration and annihilation of which appears to contribute to the dynamic conduction properties of the ZnO decorated nanoparticles. We believe this to be the first demonstration of a ZnO decorated SiO2 nanoparticle, and represents a simple yet powerful way of achieving the optical and electrical properties of ZnO combined with the simplicity of SiO2 synthesis.
DTIC
Microstructure; Morphology; Nanoparticles; Silicon Dioxide; Transport Properties; Zinc Oxides

20100020300 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling the Fate of Groundwater Contaminants Resulting from Leakage of Butanol-Blended Fuel
Vuong, Khai H.; March 2010; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519712; AFIT/GES/ENV/10-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Fuel spills and leaks from storage tanks can contaminate groundwater. Typically in groundwater, hazardous aromatic hydrocarbons like benzene are attenuated through natural processes. However, it is possible that adding butanol to gasoline will interfere with these natural attenuation processes, so that spills and leaks of alternative fuels containing biobutanol may result in more persistent hazardous aromatic hydrocarbon plumes. This effect has already been observed with ethanol, which is currently added to gasoline. A numerical model was developed to simulate the subsurface fate and transport of butanol-blended fuel to assess the potential impacts of butanol on the natural attenuation of benzene. The model incorporated advection, dispersion, sorption, and biodegradation of contaminants in groundwater. The biodegradation of benzene and butanol was modeled using dual Monod kinetics with degradation occurring under aerobic and anaerobic (sulfate-reducing as well as methanogenic) redox conditions. Model simulations indicated that spills of butanol-blended gasoline resulted in

benzene plumes that were longer and more persistent than plumes which resulted from spills of gasoline alone. Electron acceptors (oxygen and sulfate) are more available for biodegradation of benzene in fuel without butanol. The presence of butanol decreased the availability of electron acceptors - limiting benzene's degradation and causing longer plumes.
DTIC
Alcohols; Benzene; Contaminants; Ground Water; Leakage; Water Pollution

20100020301 Universal Technology Corp., Dayton, OH USA
Collaborative Research and Development (CR and D). Delivery Order 0056: Novel Nanotube Synthesis
Kim, Myung Jong; February 2008; 9 pp.; In English
Contract(s)/Grant(s): F33615-03-D-5801-0051; Proj-4349; 62102F
Report No.(s): AD-A519705; S-531-056; AFRL-RX-WP-TM-2010-4091; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted at the University of Pennsylvania in Philadelphia, PA from 31 July 2006 through 1 February 2008. This task worked to develop synthesis routes for nanotubes that are not pure carbon, e.g., boron nitride, boron-carbon nitride. Carbon nanotubes can be synthesized with relative ease in laboratory and commercial settings via simple catalytic chemical vapor deposition (CCVD) techniques; therefore, widespread access has allowed for intense study and application. BN nanotubes have proven more difficult to synthesize reliably or on scales that permit complimentary investigation and, consequently, less is known about these materials. BNNTs have been synthesized in a similar manner to carbon nanotubes such as arc discharge, laser ablation, ball milling, substitution reaction from carbon nanotubes, and chemical vapor deposition, but standard CCVD methods which enable high quality and large scale synthesis of CNT have not been properly adopted for the BNNT synthesis. Herein, we developed catalytic methods and report the achievement on the growth of BN nanotubes via catalytic pyrolysis and CVD route.
DTIC
Boron Nitrides; Nanostructure Growth; Nanostructures (Devices); Nanotubes; Pyrolysis

26
METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20100018378 BASF Catalysts, LLC, Iselin, NJ, USA
Platinum Group Metal Recycling Technology Development
Shore, Lawrence; January 2009; 42 pp.; In English
Contract(s)/Grant(s): DE-FC36-03GO13104
Report No.(s): DE2010-962699; No Copyright; Avail.: National Technical Information Service (NTIS)

The research performed at BASF from 2003 to 2009 relating to recovery of platinum group metals from fuel cell electrode membrane electrode assemblies (MEA) has been successful in inventing a single approach for processing fuel cells of differing architecture and materials of construction. The scope of the proposed process includes MEA's incorporating both catalyst-coated membranes and gas diffusion electrodes. The process is equally applicable to MEA's with membranes of both Nafion(Trademark) and non-fluoropolymeric composition. This achievement has been recognized by all involved as a necessary requirement for a commercially-viable recycling process. In addition to this accomplishment, two other project objectives, high (>98%) Pt yield and minimal environmental impact, have also been met. As currently conceived, the only waste streams are a dilute, fluorine-free, salt solution from an alkaline scrubber and the non-hazardous leached MEA residue, although value-added use of the leach residue has been provisionally proposed; emission of hydrogen fluoride and carbon dioxide are eliminated.
NTIS
Electrodes; Fuel Cells; Membranes; Metals; Platinum; Recycling

20100018681 Naval Research Lab., Washington, DC USA
Carbon Surface Modification for Enhanced Corrosion Resistance
Natishan, P M; Martin, F J; Lemieux, E J; Newbauer, T M; Rayne, R; Bayles, R A; Jan 2008; 3 pp.; In English
Report No.(s): AD-A517866; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517866

Case hardening by carburization has long been recognized to produce wear-resistant surfaces in steels. Historically, case

hardening has not been applicable to chromium-containing alloys such as stainless steels (SS), due to chromium carbide formation that significantly degraded corrosion performance. As a result, the availability of case-hardened (and consequently wear-resistant) alloys for applications in corrosive environments was extremely limited. A new low-temperature (450 deg-500 deg C) paraequilibrium carburization technique has been developed for introducing carbon into stainless steel surfaces without formation of carbides.1,2 This surface modification technique has been termed Low-Temperature Colossal Supersaturation (LTCSS). Paraequilibrium refers to the concept that the diffusion of substitutional solutes (metal atoms, such as Cr and Ni in the alloy) is slower than the diffusion of interstitial solutes (atoms such as carbon, that fit between metal alloy atoms). Substitutional solutes are effectively immobile under LTCSS treatment conditions, whereas carbon can diffuse considerable distances into the alloy.
DTIC
Carbon; Corrosion Resistance

20100018885 Naval Research Lab., Washington, DC USA
Initial Microstructural Evolution during Friction Stir Welding
Fonda, R W; Wert, J A; Reynolds, A P; Tang, W; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Friction stir welding (FSW) has become an important new technique for joining aluminum alloys. In FSW, a rotating tool is plunged into the solid metal, heating it sufficiently (without melting) that the surrounding metal can be stirred together into a solid joint. Despite the commercial success of this technique, many fundamental aspects of this welding process remain poorly understood. To address this lack of understanding, we have made the first-ever friction stir welds in a single crystal and quenched the end of the weld to freeze-in a static representation of the dynamic deformation field surrounding the tool. The single crystal starting material ensures that the FSW process is directly responsible for all the grain boundary generation and crystallographic texture evolution observed in the weld (except that from conventional recrystallization). Thus, this study is uniquely designed to reveal the initial stages of grain boundary development and texture evolution that occur during FSW.
DTIC
Friction Stir Welding; Friction Welding; Grain Boundaries; Microstructure

20100019022 Texas Univ., Arlington, TX USA
Ultra-High Sensitive Magnetoelectric Nanocomposite Current Sensors
Priya, Shashank; Kim, Choongun; Liu, J P; Dec 1, 2009; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-07-1-0435
Report No.(s): AD-A518712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sintered magnetoelectric composites generally exhibit reduced sensitivity due to: 1) breakage and aggregation of ferrite coating during compaction forming path of reduced resistivity, 2) coarsening of piezoelectric particle leading to interfacial porosity, and 3) inter-diffusion between piezoelectric and ferrite resulting in coherency loss. In order to overcome these problems, we are adopting following approach to synthesize core-shell nanocomposites: 1) create piezoelectric particles (sub-micron range) with crystallographic facets which will result in uniform stress.
DTIC
Composite Materials; Detectors; Magnetic Fields; Nanocomposites; Sensitivity

20100019042 Rockwell Scientific Co., LLC, Thousand Oaks, CA USA
Friction Stir Processing Of Aluminum Fusion Welds
Fuller, Christian; Mahoney, Marray; Bingel, William; Jan 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MDA972-02-C-0300
Report No.(s): AD-A518810; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Friction stir processing (FSP) is used to modify the microstructure and the resultant properties of fusion welded aluminum alloys. Non-heat treatable 5083-H321 Al is subjected to FSP at the fusion weld toe, crown, and heat-affected zone locations. FSP affects both the local fusion weld microstructure and residual stresses. To understand the influence of FSP on fusion welds, the effect of different FSP processing approaches is investigated. The morphology and spatial distribution of precipitates and grains are examined through optical microscopy, scanning electron microscopy, and transmission electron microscopy. The relationships between microstructure and properties such as strength and ductility are discussed. Consideration is given to the

local properties in transition regions between the different microstructures, i.e., fine grain FSP zone, cast fusion zone, and parent metal.
DTIC
Aluminum; Aluminum Alloys; Friction; Friction Stir Welding; Fusion Welding; Microstructure; Welded Joints

20100019043 Rockwell Scientific Co., LLC, Thousand Oaks, CA USA
Friction-Stir Processing
Mahoney, M W; Lynch, S P; Jan 2006; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Friction-stir processing (FSP) is an emerging surface-engineering technology that can locally eliminate casting defects and refine microstructures, thereby improving strength and ductility, increase resistance to corrosion and fatigue, enhance formability, and improve other properties. FSP can also produce fine-grained microstructures through the thickness to impart superplasticity. The technology involves plunging a rapidly rotating, non-consumable tool, comprising a profiled pin and larger diameter shoulder, into the surface and then traversing the tool across the surface. Large surface areas can be traversed rapidly by using the appropriate tool design accompanied by rastering. Frictional heating and extreme deformation occurs causing plasticised material (constrained by the shoulder) to flow around the tool and consolidate in the tool's wake. FSP zones can be produced to depths of 0.5 to 50mm, with a gradual transition from a fine-grained, thermodynamically worked microstructure to the underlying original microstructure. FSP has been applied to Al, Cu, Fe, and Ni-based alloys with resulting property improvements. Details of the benefits and limitations of FSP, along with examples of current and potential applications are presented below. Some examples of benefits include (1) a doubling of strength of cast nickel-aluminium-bronze, (2) a five-fold increase in ductility of Al alloy A356, (3) increased fatigue life by friction stir processing the surface of fusion welds, (4) depending on the microstructure, a 3 to 20 times increase in the corrosion resistance of a Cu-Mn alloy, and (5) bending of 25 mm thick 2519 Al plate to 85 at room temperature without surface cracking. The additional advantages of low-plasticity burnishing (LPB) following FSP, to change any residual near-surface tensile stresses introduced by FSP to compressive residual stresses, are also discussed.
DTIC
Ductility; Fatigue Life; Friction; Friction Stir Welding; Fusion Welding; Residual Stress

20100019051 Centre National de la Recherche Scientifique, Orsay, France
Physical Origin of the Frequency Shifts in Cesium Beam Frequency Standards: Related Environmental Sensitivity
Audoin, C; Dimarcq, N; Giordano, V; Viennet, J; Dec 1990; 22 pp.; In English
Report No.(s): AD-A518823; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When observed in a cesium beam frequency standard, the hyperfine transition frequency of the atoms differs slightly from the invariant transition frequency of the unperturbed atoms at rest. The various physical and technical origins of the frequency offsets are stated. They relate to fundamental physical effects, to the method of probing the atomic resonance and to the frequency control of the slaved oscillator. The variation of the frequency offsets under a change of the value of the internal operational characteristics is considered. The sensitivity to a change of the magnetic induction, the microwave power and the temperature is given. A comparison is made of the sensitivity of cesium beam frequency standards of the commercially available type, making use of magnetic state selection, and of devices under study, in which the state preparation and detection is accomplished optically. The pathways between the external stimuli and the physical origin of the frequency offsets are specified.
DTIC
Atomic Clocks; Cesium; Electron Tubes; Frequencies; Frequency Shift; Particle Beams; Sensitivity

20100019388 Oak Ridge National Lab., TN, USA; Liverpool Univ., UK
Summary of Prior Work on Joining of Oxide Dispersion-Strengthened Alloys
Wright, I. G.; Tatlock, G.; Al-Badairy, H.; Chen, C. L.; May 01, 2009; 98 pp.; In English
Contract(s)/Grant(s): DE-AC05-00OR22725
Report No.(s): DE2010-969976; ORNL/TM-2009/138; No Copyright; Avail.: National Technical Information Service (NTIS)

There is a range of joining techniques available for use with ODS alloys, but care should be exercised in matching the technique to the final duty requirements of the joint. The goal for joining ODS alloys is a joint with no local disruption of the distribution of the oxide dispersion, and no significant change in the size and orientation of the alloy microstructure. Not

surprisingly, the fusion welding processes typically employed with wrought alloys produce the least satisfactory results with ODS alloys, but some versions, such as fusion spot welding, and the laser and electron-beam welding technologies, have demonstrated potential for producing sound joints. Welds made using solid-state spot welding reportedly have exhibited parent metal properties. Thus, it is possible to employ processes that result in significant disruption of the alloy microstructure, as long as the processing parameters are adjustment to minimize the extent of or influence of the changes in the alloy microstructure. Selection among these joining approaches largely depends on the particular application and component configuration, and an understanding of the relationships among processing, alloy microstructure, and final properties is key. Recent developments have resulted in friction welding evolving to be a prime method for joining ODS sheet products, and variants of brazing/diffusion bonding have shown excellent promise for use with tubes and pipes. The techniques that come closest to the goal defined above involve solid-state diffusion bonding and, in particular, it has been found that secondary recrystallization of joints made by pulsed plasma-assisted diffusion can produce the desired, continuous, large alloy grain structure through the joint. Such joints have exhibited creep rupture failure at >82% of the load needed to fail the monolithic parent alloy at 1000 C.

NTIS

Oxide Dispersion Strengthening; Laser Welding; Diffusion Welding; Electron Beam Welding; Wrought Alloys; Welded Joints; Plasma Diffusion; Metal Bonding

20100019432 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development of a Flapping Wing Design Incorporating Shape Memory Alloy Actuation

Barrett, Jeffery A.; March 2010; 111 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-09ENY152

Report No.(s): AD-A518017; AFIT/GAE/ENY/10-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518017

This research sought to validate a proof of concept regarding shape memory alloy actuation of a flapping-wing blimp. Specimen wires were subjected to cyclic voltage at increasing frequencies to quantify expected strains. A laser vibrometer captured 2048 sample velocities during single contraction and elongation cycles, and the resulting samples were used to calculate displacements. Displacements were determined ten times for each specimen and frequency to compute averages. Subsequently, a circumventing frame was designed to encase a blimp envelope and provide support for a flapping motion actuation system. Contraction of shape memory wire translated force to the flapping mechanism via bellcranks, pushrods, and clevises, while bias springs promoted elongation of the wire during power-off phases. Performance characteristics of the flapping system, augmented with each specimen wire individually, were determined during bench-top testing. A modified frame was constructed to reduce weight and fitted to a larger envelope due to buoyancy limitations of the original envelope. A circuit was constructed, cycling voltage at 0.2 hertz, to actuate the specimen wires. Performance of the system was observed with the incorporation of each specimen. Optimum performance was realized with the 0.005 inch diameter specimen wire, producing 25 to 35 degrees wing deflection.

DTIC

Aircraft Design; Flapping; Shape Memory Alloys; Wings

20100019952 Dayton Univ. Research Inst., OH USA

Hybrid R-Fe-B/R-Co Magnets with Improved Thermal Stability

Shen, Y; Higgins, A; Chen, C; Liu, S; Dec 23, 2009; 53 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0274

Report No.(s): AD-A519522; UDR-TR-2009-00204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hybrid Pr2(Fe,Co)14B/Pr(Co,Fe)5 magnets with nanograin and micrograin structures were studied and synthesized in this project using various processes, including a rapid hot press and hot deformation process, a conventional sintering process, and a rapid induction sintering process. Hybrid Pr2(Fe,Co)14B/ Pr(Co,Fe)5 magnets demonstrated improved long-term thermal stability as compared with those containing no Pr(Co,Fe)5 components. The possibility of applying nanoparticles to synthesize bulk magnets was also explored. A PrCo5 nanopowder was produced by surfactant-assisted high-energy ball milling, and PrCo5 bulk magnets were successfully fabricated by compaction at 200 to approximately 525 degrees C using the nanopowder. The bulk magnet has cluster microstructure with nanocrystalline. The density of the bulk up to 92% theoretical value was obtained.

DTIC

Magnets; Microstructure; Permanent Magnets; Thermal Stability

20100019956 Massachusetts Inst. of Tech., Cambridge, MA USA
Mechanics of Metals with Grain Sizes Approaching the Amorphous Limit
Schuh, Christopher A; Oct 31, 2009; 10 pp.; In English
Contract(s)/Grant(s): DAAD19-03-1-0235
Report No.(s): AD-A519533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This PECASE award studied the similarities between amorphous and nanocrystalline alloys, in terms of their structure, thermodynamics, and mechanical properties. Three task lines in alloy design and processing, characterization, and mechanical property testing and optimization, were pursued in parallel, using both experimental and theoretical/computation methods. The work resulted in: (i) A new approach to control the grain size in nanocrystalline alloys, developed through the use of thermodynamic principles of metal glass formation; (ii) identification of critical nanostructural scales at which alloys exhibit optimized properties under high-rate or impact loading conditions, and (iii) introduction of a practical route to optimized nanostructured alloys with scale-up potential.
DTIC
Alloys; Amorphous Materials; Mechanical Properties; Metals; Nanostructures (Devices)

20100020217 General Accounting Office, Washington, DC USA
Defense Management: Observations on Department of Defense and Military Service Fiscal Year 2011 Requirements for Corrosion Prevention and Control
Apr 15, 2010; 32 pp.; In English
Report No.(s): AD-A518892; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518892

This report formally transmits the attached briefing (see enc. I) in response to the Senate Appropriations Committee Report accompanying the Department of Defense Appropriations Bill for fiscal year 2010 (S. Rep. No. 111-74, pp. 155-156). The Committee Report requires the Government Accountability Office to provide information on the differences between Department of Defense and Military Service requirements for corrosion prevention and control projects for fiscal year 2011 and provide the results to the Senate Appropriations Committee within 60 days after submission of the Department of Defense budget. On April 2, 2010, we provided the briefing to your Committee's staff to satisfy the direction to provide information and the 60-day reporting requirement. As the Committee Report also requires, we will provide a report later in the year on selected corrosion control projects. The Related GAO Products section at the end of this report lists additional GAO publications on this issue.
DTIC
Corrosion Prevention; Military Operations

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20100018375 New Hampshire Dept. of Transportation, Concord, NH, USA
Precast Concrete Deck Panel Performance on Long Span, High Traffic Volume Bridges
Whittemore, Mark D.; Stamnas, Peter E.; Wellman, Raymond; February 2006; 42 pp.; In English
Contract(s)/Grant(s): 13733D
Report No.(s): PB2010-105914; FHWA-NH-RD-13733D; No Copyright; Avail.: CASI: A03, Hardcopy

The NHDOT prohibited the use of partial depth precast deck panels on its long span, high traffic volume bridges until it could investigate if the precast slabs and the concrete overpour were acting in a composite manner. The NHDOT also wanted to ensure that there was adequate transfer of traffic loads between the panels without causing reflective cracking. The purpose of this project was to investigate these two issues. The NHDOT reconstructed the deck of the I-393 bridge over the Merrimack River in Concord using precast concrete slabs and a concrete overpour in 2002-2003. Cores were taken from this bridge deck to evaluate the composite behavior of the slabs and overpour and cracking was evaluated. Cores were taken before the introduction of traffic and then after the deck had been exposed to traffic for several months. Cracking was evaluated before and after traffic. The cores taken were subjected to tensile and shear strength testing across the panel/overpour interface and were found to perform satisfactorily. The tests provided conclusive evidence that there was excellent bond between the deck slabs and the overpour and that the strength of the bond was actually improving slightly over time. An inspection of the deck

before and after traffic loading revealed that the panels were adequately transferring traffic loading without causing reflective cracking. Based on these results the NHDOT will permit the use of this type of deck construction on long span, high traffic volume bridges.
NTIS
Concretes; Panels; Traffic

20100018393 Westinghouse Savannah River Co., Aiken, SC, USA
Glass Feasibility Study: Vitrification of Oak Ridge National Laboratory Gunite Waste Using Iron Phosphate Glass
Fellinger, T. L.; March 1996; 37 pp.; In English
Contract(s)/Grant(s): DE-AC09-89SR18035
Report No.(s): DE2009-966783; WSRC-TR-96-0084-REV-0; No Copyright; Avail.: Department of Energy Information Bridge

This report describes the results of a glass feasibility study on vitrification of Oak Ridge National Laboratory (ORNL) Gunite waste into an Iron Phosphate glass. This glass feasibility study is part of a larger ORNL Gunite and Associated Tanks Treatability program (TfP No.SRI-6-WT-31) 1. The treatability program explores different immobilization techniques of placing Gunite waste into a glass or grout form for long term storage. ORNL Gunite tanks contain waste that originated from years of various ORNL Research and Development programs.
NTIS
Glass; Iron; Phosphates; Polonium Isotopes; Radioactive Isotopes; Vitrification

20100018644 Library of Congress, Washington, DC USA
Russian Energy Policy Toward Neighboring Countries
Woehrel, Steven; Mar 22, 2010; 26 pp.; In English
Report No.(s): AD-A517758; CRS-RL34261; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517758

The Russian oil and natural gas industries are key players in the global energy market, particularly in Europe and Eurasia. Another trend has been the concentration of these industries in the hands of the Russian government. This latter phenomenon has been accompanied by an authoritarian political system, in which former intelligence officers play key roles. Russian firms have tried to purchase a controlling stake in pipelines, ports, storage facilities, and other key energy assets of European countries. They need these assets to transport energy supplies to lucrative western European markets, as well as to secure greater control over the domestic markets of the countries of the region. In several cases where assets were sold to non-Russian firms, Russian firms cut off energy supplies to the facilities. Russia has also tried to build new pipelines to circumvent infrastructure that it does not control. Another objective Russia has pursued has been to eliminate the energy subsidies former Soviet republics have received since the fall of the Soviet Union, including by raising the price these countries pay for natural gas to world market prices. It is not completely clear whether the pursuit of Russian foreign policy objectives is the primary explanation for the actions of its energy firms. Few would disagree in principle that the elimination of subsidies to post-Soviet countries is a sound business decision, even if questions have been raised about the timing of such moves. Even the pursuit of multiple pipelines can be portrayed as a business decision. On the other hand, many countries of the region are concerned that Russia may use their energy dependency to interfere in their domestic affairs or to force them to make foreign policy concessions. Countries of the region also fear that by controlling energy infrastructure in their countries, Russian energy firms are able to manipulate the internal political situation by favoring certain local businessmen and politicians
DTIC
Energy Policy; Natural Gas; Oils; Russian Federation

20100018703 Massachusetts Univ., Amherst, MA USA
Ferritin-Polymer Conjugates: Grafting Chemistry and Self-Assembly
Russell, T; Balazs, A; Emrick, T; Tew, G; Wang, Q; Walker, G; Oct 26, 2009; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0191
Report No.(s): AD-A517929; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517929

In the MURI program on Bio-Directed Hierarchical Assembly of Multifunctional Materials we have developed routes to isolate, purify and functionalize symmetric and asymmetric bionanoparticles (viruses) in large quantities; investigated their

interfacial assembly; their co-assembly with synthetic block copolymers, and developed chemistries on the assembled nanoparticles for encapsulation and delivery applications. Our theoretical studies have guided us in defining the parameters that control the assemblies at fluid interfaces, in multilayered composites.
DTIC
Grafting; Healing; Polymer Chemistry; Proteins; Self Assembly

20100018881 Hannam Univ., Daejeon, Korea, Republic of
Hybrid Inorganic/Organic Photovoltaics: Translating Fundamental Nanostructure Research to Enhanced Solar Conversion Efficiency
Lee, Kwang-Sup; Cartwright, Alex N; Prasad, Paras N; He, Sailing; Dec 31, 2008; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA4869-08-1-4012
Report No.(s): AD-A518297; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is the report for a project to design and characterize conjugated oligomers/polymers and surface capping linkers for quantum dots, aimed towards facilitating the charge separation and enhancing the mobilities of carriers, which can lead to highly efficient quantum dot:carbon nanotubes: polymer nanocomposites based solar cells. These studies will significantly contribute to the understanding of efficient quantum-dot based solar cell architectures. The details are given below; - Preparation of various quantum dots, conjugated oligomers and polymers. - Enhanced broadband energy harvesting using engineered and surface functionalized semiconductor nanocrystals (quantum dots) of various sizes, shapes and compositions. - Enhanced exciton dissociation and minimized recombination via bandgap-engineered multicomponent hybrid nanocrystals through control of interfacial chemistry and linkage to other components. - Enhanced and balanced carrier mobility and efficient charge transfer through the incorporation of carbon nanotubes into organic matrices containing conjugated molecules. - Introduction of conjugated linker molecules for interconnection of inorganic nanocrystals and nanotubes for improved electron transfer between these nanoscale components.
DTIC
Energy Conversion Efficiency; Nanostructure (Characteristics); Polymers; Quantum Dots

20100019179 State Univ. of North Texas, Denton, TX USA
COLLABORATIVE RESEARCH and DEVELOPMENT (CR&D) Delivery Order 0023: Molecular Simulation for Material Design Limits
Schwartz, Martin; Nov. 2005; 59 pp.; In English
Contract(s)/Grant(s): F33615-03-D-5801-0023; Proj-4349
Report No.(s): AD-A517918; S-531-0023; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517918

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted at Wright-Patterson AFB, Ohio during two summer sessions from 1 May 2004 through 31 Aug 2005. The research investigated the ability of Molecular Dynamics simulations to replicate the mechanical properties of Parmax self-reinforced polymers. This report presents details of the simulation, test procedures, and results.
DTIC
Mechanical Properties; Molecular Dynamics; Polymers; Simulation

20100019191 Army Research Lab., Aberdeen Proving Ground, MD USA
Predicting Morphology of Polymers Using Mesotek+
Chantawansri, Tanya L; Lennon, Erin M; Andzelm, Jan; Feb. 2010; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-H84
Report No.(s): AD-A518621; ARL-TR-5087; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When new polymeric materials are designed, it is desirable if computational modeling can be used to predict microscale self assembly and physical properties. Field theoretic methods such as self-consistent field theory have been used to accurately model the self-assembly behavior for a variety of dense polymeric systems of high molecular weight. This theory, as developed by Glenn Fredrickson and coworkers, has been programmed into a C++ code called Mesotek+. This report presents a theory overview and an introduction on how to use the program. An input file is then produced for Mesotek+ to reproduce

the phase behavior for an experimental system of poly (styrene-b-isoprene) in the solvent tetradecane (C-14).
DTIC
Morphology; Polymers; Predictions; Programming Languages

20100019241 Universal Technology Corp., Dayton, OH USA
Collaborative Research and Development Contract. Delivery Order 0052: Microvascular Composites
Phillips, David M.; May 2008; 17 pp.; In English
Contract(s)/Grant(s): F33615-03-D-5801-0052; Proj-4349; 62102F
Report No.(s): AD-A517827; AFRL-RX-WP-TM-2010-4089; S-531-052; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517827

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted from 3 May 2006 through 1 May 2008. This task worked to develop new classes of composite materials with mass transporting and sensing capability for improved performance in structural applications. Structures that have embedded microfluidic networks have the potential to bring a range of multifunctionality and adaptability to aerospace structures including active cooling, self-healing, structural health monitoring, and morphing structures. This will ultimately enable increased persistence, responsiveness, and multi-mission capability of structures that use this technology. We examine fiber-reinforced polymer composite processing techniques to create scalable, hierarchical fluidic networks within polymer-based hybrid materials. This includes the investigation of microvascular composite fabrication methods for lined and unlined channel formation, investigation of fundamental thermal transport characteristics, and characterization of the range of adaptive mechanical properties.
DTIC
Composite Materials; Fabrication

20100019355 Air Force Research Lab., Wright-Patterson AFB, OH USA
Polymeric Materials
Vaia, Richard A; Jun. 2009; 42 pp.; In English
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A518318; AFRL-RX-WP-TM-2009-4203; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes the technical progress of the in-house projects supporting the Polymeric Materials Effort, Materials and Manufacturing Directorate, Air Force Research Laboratory. These include structurally and morphologically tailored materials for improved photovoltaic and molecular electronic responses; bio-derived photonic assemblies; advanced polymeric materials; polymer nanostructured materials; and polymer nanostructured materials (PNMs).
DTIC
Nanostructures (Devices); Polymers

20100019360 Army Research Lab., Aberdeen Proving Ground, MD USA
Evaluation of a Foreign Silicon Nitride as a Potential Gun Barrel Liner
Swab, Jeffrey J; Danna, Dominic; Leveritt, Charles; Piraino, Stephanie; Apr. 2010; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH80
Report No.(s): AD-A518417; ARL-TR-5146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A silicon nitride (Si3N4) ceramic manufactured by FCT Technologie GmbH, Rauenstein, Germany was subjected to a series of tests (mechanical, physical, thermal, and erosion) to determine if this material might have potential applications as gun barrel liners. The tests conducted were similar to earlier tests performed by the U.S. Army Research Laboratory (ARL) on a variety of ceramic materials, including silicon nitride, for the same application. The erosion behavior was comparable to the previously tested ceramics but the mechanical and thermal properties were inferior making it unlikely that it would survive the interior ballistic conditions of a gun barrel.
DTIC
Evaluation; Linings; Silicon Nitrides; System Effectiveness

20100019382 Department of Energy, Richland, WA, USA

Melt Rate Enhancement for High Aluminum HLW (High Level Waste) Glass Formulation Final Report 08R1360-1

Kruger, A. A.; Matlack, K. S.; Kot, W.; Pegg, I. L.; Joseph, I.; January 01, 2010; 313 pp.; In English

Contract(s)/Grant(s): DE-AC27-08RV14800

Report No.(s): DE2010-970007; ORP-44236-REV-0; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes the development and testing of new glass formulations for high aluminum waste streams that achieve high waste loadings while maintaining high processing rates. The testing was based on the compositions of Hanford High Level Waste (HLW) with limiting concentrations of aluminum specified by the Office of River Protection (ORP). The testing identified glass formulations that optimize waste loading and waste processing rate while meeting all processing and product quality requirements. The work included preparation and characterization of crucible melts and small scale melt rate screening tests. The results were used to select compositions for subsequent testing in a DuraMelter 100 (DM100) system. These tests were used to determine processing rates for the selected formulations as well as to examine the effects of increased glass processing temperature, and the form of aluminum in the waste simulant. Finally, one of the formulations was selected for large-scale confirmatory testing on the HLW Pilot Melter (DM1200), which is a one third scale prototype of the Hanford Tank Waste Treatment and Immobilization Plant (WTP) HLW melter and off-gas treatment system. This work builds on previous work performed at the Vitreous State Laboratory (VSL) for Department of Energy (DOE) to increase waste loading and processing rates for high-iron HLW waste streams as well as previous tests conducted for ORP on the same high-aluminum waste composition used in the present work and other Hanford HLW compositions.

NTIS

Aluminum; Augmentation; Glass; Radioactive Wastes

20100019387 Department of Energy, Aiken, SC, USA

Effects of Tritium Gas Exposure on Electrically Conducting Polymers

Kane, Marie C.; Clark, Elliot A.; Laseola, Robert J.; December 01, 2009; 17 pp.; In English

Contract(s)/Grant(s): DE-AC09-08SR22470

Report No.(s): DE2010-969994; SRNL-STI-2009-00761; No Copyright; Avail.: National Technical Information Service (NTIS)

Effects of beta (tritium) and gamma irradiation on the surface electrical conductivity of two types of conducting polymer films are documented to determine their potential use as a sensing and surveillance device for the tritium facility. It was shown that surface conductivity was significantly reduced by irradiation with both gamma and tritium gas. In order to compare the results from the two radiation sources, an approximate dose equivalence was calculated. The materials were also sensitive to small radiation doses (<10(sup 5) rad), showing that there is a measurable response to relatively small total doses of tritium gas. Spectroscopy was also used to confirm the mechanism by which this sensing device would operate in order to calibrate this sensor for potential use. It was determined that one material (polyaniline) was very sensitive to oxidation while the other material (PEDOT-PSS) was not. However, polyaniline provided the best response as a sensing material, and it is suggested that an oxygen-impermeable, radiation-transparent coating be applied to this material for future device prototype fabrication. A great deal of interest has developed in recent years in the area of conducting polymers due to the high levels of conductivity that can be achieved, some comparable to that of metals (Gerard 2002).

NTIS

Conducting Polymers; Electrical Resistivity; Exposure; Tritium

20100019453 Naval Undersea Warfare Center, Newport, RI USA

Crimp-Imbalanced Protective (CRIMP) Fabrics

Cavallaro, Paul V.; Sadegh, Ali M; Mar. 31, 2010; 86 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518258; NUSC-TR-11957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518258

This report documents the research that was conducted to explore the unique concept of using crimp imbalance, which is a simple architectural modification achieved during the weaving process, as a potential mechanism to enhance fragmentation and ballistic protection levels of single-ply woven fabrics. It is shown in this report that crimp imbalance (1) can substantially influence the energy absorption levels of single-ply fabrics for select fragment simulating projectile velocities, friction coefficients, and impact angles; (2) can be tailored to controllably delay stress-wave propagations among yarn directions; and (3) can minimize reflections at the yarn crossover regions. This research, through single-ply numerical models, demonstrated that deviations in crimp contents can have significant effects on energy absorptions and projectile residual velocities; in short,

optimal levels of crimp imbalance may exist for a specific ballistic threat type.
DTIC
Armor; Fabrics; Protection; Weaving

20100019461 Army Tank-Automotive and Armaments Command, Warren, MI USA
A Comprehensive Study on the Mechanical and Thermal Properties of Nanoclay Reinforced Polymers at Various Temperatures
Bayar, Selen; March 4, 2010; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W56HZV-09-C-0569
Report No.(s): AD-A518006; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518006

In this study, the mechanical and thermal properties of nanoclay reinforced polymer resins are investigated at various temperatures. The effect of nanoclay reinforcement was elicited by varying its weight percentage from 0% to 10% in the polymer. Three different polypropylene (PP) resins were studied. The temperature was varied from -65 F (-54 C) to 160 F (71 C). To predict the experimental results a micromechanical model based on the Mori-Tanaka formulation was developed. The results indicate that the addition of nanoclay to PP leads to a stronger and stiffer nanocomposite. It was also found that the strength and stiffness of PP are drastically reduced at higher temperatures. However, nanoclay reinforcement somewhat mitigates this deterioration. The comparison of the theoretical and experimental results indicates that the Mori-Tanaka formulation may be a useful tool to predict these mechanical properties.
DTIC
Mechanical Properties; Polypropylene; Thermodynamic Properties

20100019477 Oak Ridge Inst. for Science and Education, Belcamp, MD USA
Experimental Evaluation of Dynamic Crack Branching in Poly(methyl methacrylate) (PMMA) Using the Method of Coherent Gradient Sensing
Umberger, Pierce; February 2010; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): ORISE-1120-1120-99
Report No.(s): AD-A518614; ARL-CR-637; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We investigate the experimental setup and methods to evaluate the characteristics of dynamic crack branching in poly(methyl methacrylate) (PMMA). The method of coherent gradient sensing is used to determine crack tip location and crack mode mixity in samples dynamically loaded via a projectile from a gas gun. We study crack propagation velocities as a function of impact velocity and its effect on crack path and branching. We also note the effect of branching on crack velocity as one or more cracks move through a material.
DTIC
Acrylates; Crack Propagation; Detection; Gradients; Polymethyl Methacrylate

20100019504 Akron Rubber Development Lab., Inc., Akron, OH, USA
Diffusion Limited Oxidation (DLO) Modeling of Tires During Oven Aging
Terrill, Esward R.; Centea, Mark; Pannikottu, Abraham; Karmarkar, Uday; Evans, Larry R.; February 2010; 62 pp.; In English
Contract(s)/Grant(s): DTNH22-03-D-08660; DTNH22-07-D-00060
Report No.(s): PB2010-107404; DOT HS 811 266; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is the sixth in a series of scientific reports intended to provide an understanding of the chemical reactions responsible for the degradation of light vehicle tires during on-vehicle service. The report series was used to guide the agency's development of a laboratory-based accelerated service life test for light vehicle tires (i.e., 'tire aging test'). Oven aging tires at 55 to 65 degrees C, while pressurized with an oxygen-rich inflation gas, has been identified as the primary candidate for a tire aging test. However, the agency was cautioned that the level of oxygen required for reactions within the tire rubber at the higher oven temperatures could exceed the supply of the oxygen diffusing to the rubber components, resulting in an effect termed Diffusion Limited Oxidation (DLO). DLO could result in the outermost layers of the tires experiencing anaerobic (without oxygen) reactions that are not representative of what light vehicle tires experience during normal service. To explore these concerns, the oxidation rates in the shoulder region of twenty four tire models were predicted at two temperatures (55 degrees C and 65 degrees C) using a computer model. To confirm simulation results, chemical and physical property data was taken from the shoulder region of the tire models before and after actual oven aging at the same conditions as were simulated by the computer model. The computer simulations predicted that none of the tires would experience DLO at 55 degrees C oven

aging, and conversely that all of the shoulder regions would experience some DLO at 65 degrees C, especially in the tread of light truck tires.
NTIS
Oxidation; Service Life; Tires; Accelerated Life Tests; Thermal Degradation

20100019518 Saint Peter's Coll., Jersey City, NJ, USA
Application of Self-Propagating High Temperature Synthesis to the Fabrication of Actinide Bearing Nitride and Other Ceramic Nuclear Fuels
Moore, J. J.; Reigel, M. M.; Donohoue, C. D.; Apr. 30, 2009; 5 pp.; In English
Contract(s)/Grant(s): FC07-05ID14648
Report No.(s): DE2010-951763; DOE/FC/14648-1; No Copyright; Avail.: Department of Energy Information Bridge

The project uses an exothermic combustion synthesis reaction, termed self-propagating high-temperature synthesis (SHS), to produce high quality, reproducible nitride fuels and other ceramic type nuclear fuels (cercers and cermets, etc.) in conjunction with the fabrication of transmutation fuels. The major research objective of the project is determining the fundamental SHS processing parameters by first using manganese as a surrogate for americium to produce dense Zr-Mn-N ceramic compounds. These fundamental principles will then be transferred to the production of dense Zr-Am-N ceramic materials. A further research objective in the research program is generating fundamental SHS processing data to the synthesis of (i) Pu-Am-Zr-N and (ii) U-Pu-Am-N ceramic fuels. In this case, Ce will be used as the surrogate for Pu, Mn as the surrogate for Am, and depleted uranium as the surrogate for U. Once sufficient fundamental data has been determined for these surrogate systems, the information will be transferred to Idaho National Laboratory (INL) for synthesis of Zr-Am-N, Pu-Am-Zr-N and U-Pu-Am-N ceramic fuels. The high vapor pressures of americium (Am) and americium nitride (AmN) are cause for concern in producing nitride ceramic nuclear fuel that contains Am. Along with the problem of Am retention during the sintering phases of current processing methods, are additional concerns of producing a consistent product of desirable homogeneity, density and porosity.
NTIS
Actinide Series; Ceramic Nuclear Fuels; Combustion Synthesis; Fabrication; High Temperature; Nitrides; Nuclear Fuels; Self Propagation

20100019520 Michigan State Univ., East Lansing, MI, USA
Diamond and Hydrogenated Carbons for Advanced Batteries and Fuel Cells: Fundamental Studies and Applications
Swain, G. M.; Apr. 13, 2009; 8 pp.; In English
Contract(s)/Grant(s): FG02-01ER15120
Report No.(s): DE2010-951069; DOE/ER-15120-1; No Copyright; Avail.: National Technical Information Service (NTIS)

The original funding under this project number was awarded for a period 12/1999 until 12/2002 under the project title Diamond and Hydrogenated Carbons for Advanced Batteries and Fuel Cells: Fundamental Studies and Applications. The project was extended until 06/2003 at which time a renewal proposal was awarded for a period 06/2003 until 06/2008 under the project title Metal/Diamond Composite Thin-Film Electrodes: New Carbon Supported Catalytic Electrodes. The work under DE-FG02-01ER15120 was initiated about the time the PI moved his research group from the Department of Chemistry at Utah State University to the Department of Chemistry at Michigan State University. This DOE-funded research was focused on (i) understanding structure-function relationships at boron-doped diamond thin-film electrodes, (ii) understanding metal phase formation on diamond thin films and developing electrochemical approaches for producing highly dispersed electrocatalyst particles (e.g., Pt) of small nominal particle size, (iii) studying the electrochemical activity of the electrocatalytic electrodes for hydrogen oxidation and oxygen reduction and (iv) conducting the initial synthesis of high surface area diamond powders and evaluating their electrical and electrochemical properties when mixed with a Teflon binder.
NTIS
Carbon; Diamonds; Electric Batteries; Fuel Cells; Hydrogenation

20100019556 Environmental Protection Agency, Washington, DC USA
Bisphenol A Action Plan. (CASRN 80-05-7)
Mar. 29, 2010; 22 pp.; In English
Report No.(s): PB2010-108684; No Copyright; Avail.: CASI: A03, Hardcopy

Bisphenol A (BPA) is a high production volume (HPV) chemical widely used in manufacturing polycarbonate plastics and epoxy resins used in many industries. Humans appear to be exposed primarily through food packaging uses of products

manufactured using BPA, although those products account for less than 5% of the BPA used in this country. Releases of BPA to the environment exceed one million pounds per year. EPA intends to consider initiating immediate actions addressing BPA in the environment based on concerns for potential effects in aquatic species. At the same time, EPA will continue to work with the Food and Drug Administration (FDA), the Centers for Disease Control and Prevention (CDC), and the National Institute of Environmental Health Sciences (NIEHS) to better determine and evaluate the human health consequences of BPA exposures. Based on the results of those efforts, EPA will consider whether further action is needed to address human health risks resulting from non-food-packaging uses of BPA.
NTIS
Bisphenols; Toxicology

20100019703 Johns Hopkins Univ., Baltimore, MD USA
Controlled Dynamic Fragmentation of Ceramics
Molinari, J F; Dec 14, 2009; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-05-1-0370; W911NF-08-1-0150
Report No.(s): AD-A519006; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519006

Fragmentation is a key damage mechanism determining ballistic impact performance of ceramic armors as well as reliability of gun barrels. This program, which was sponsored by the Army Research Office, focuses on the relation between defect populations and fragment-size distributions via robust physics-based numerical simulations. The originality of the present simulations lies in the capability of dealing with fragmentation of large and heterogeneous structures. The understanding of how the microstructure acts on the global macroscopic response is our main concern. Defects are strategically placed during the design of a material or a structure in order to optimize the geometrical (shape and size) or velocity characteristics of fragments.
DTIC
Armor; Ballistics; Ceramics; Fragmentation

20100019759 Pennsylvania Univ., Philadelphia, PA USA
Plastic Flow and Failure Resistance of Metallic Glass: Insight from In Situ Compression of Nanopillars
Shan, Z W; Li, Ju; Cheng, Y Q; Minor, A M; Asif, S A; Warren, C L; Ma, E; Apr 14, 2008; 8 pp.; In English
Contract(s)/Grant(s): N00014-05-1-0504; NSF-DMR-0502711
Report No.(s): AD-A519167; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519167

We report in situ nanocompression tests of Cu-Zr-Al metallic glass MG pillars in a transmission electron microscope. This technique is capable of spatially and temporally resolving the plastic flow in MGs. The observations reveal the intrinsic ability of fully glassy MGs to sustain large plastic strains, which would otherwise be preempted by catastrophic instability in macroscopic samples and conventional tests. The high ductility in volume-limited MGs and the sample size effects in suppressing the rapid failure common to MGs are analyzed by modeling the evolution of the collectivity of flow defects toward localization.
DTIC
Compressibility; Failure; Flow Resistance; Metallic Glasses; Nanostructures (Devices); Plastic Flow

20100019922 California Univ., Berkeley, CA USA
Early Stage Expansion and Time-Resolved Spectral Emission of Laser-Induced Plasma from Polymer
Boueri, Myriam; Baudelet, Matthieu; Yu, Jin; Mao, Xianglei; Mao, Samuel S; Russo, Richard; Jan 2009; 7 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446
Report No.(s): AD-A519462; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the nanosecond laser ablation regime, absorption of laser energy by the plasma during its early stage expansion critically influences the properties of the plasma and thus its interaction with ambient air. These influences can significantly alter spectral emission of the plasma. For organic samples especially, recombination of the plasma with the ambient air leads to interfering emissions with respect to emissions due to native species evaporated from the sample. Distinguishing interfering emissions due to ambient air represents a critical issue for the application of laser-induced breakdown spectroscopy (LIBS) to the analysis of organic materials. In this paper, we report observations of early stage expansion and interaction with ambient air of the plasma induced on a typical organic sample (nylon) using timeresolved shadowgraph. We compare, in the

nanosecond ablation regime, plasmas induced by infrared (IR) laser pulses (1064 nanometers) and ultraviolet (UV) laser pulses (266 nanometers). Nanosecond ablation is compared with femtosecond ablation where the post-ablation interaction is absent. Subsequent to the early stage expansion, we observe for each studied ablation regime, spectral emission from CN, a typical radical for organic and biological samples. Time-resolved LIBS allows identifying emissions from native molecular species and those due to recombination with ambient air through their different time evolution behaviors.
DTIC
Ablation; Emittance; Laser Applications; Laser Plasmas; Laser-Induced Breakdown Spectroscopy; Plasmas (Physics); Polymers; Radicals; Shadowgraph Photography; Spectra; Spectral Emission

20100019999 Nevada Univ., Reno, NV USA
A Review of Recent Research on Mechanics of Multifunctional Materials and Structures
Gibson, Ronald F; Mar 15, 2010; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-09-1-0506
Report No.(s): AD-A519640; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is an attempt to identify the topics that are most relevant to multifunctional materials and structures and review representative journal publications that are related to those topics. Articles covering developments in both multiple structural functions and integrated structural and nonstructural functions since 2000 are emphasized. Structural functions include mechanical properties like strength, stiffness, fracture toughness, and damping, while nonstructural functions include electrical and/or thermal conductivity, sensing and actuation, energy harvesting/storage, self-healing capability, and electromagnetic interference (EMI) shielding. Many of these recent developments are associated with polymeric materials and corresponding advances in nanomaterials and nanostructures, as are many of the articles reviewed. The report concludes with a discussion of recent applications of multifunctional materials and structures. Several suggestions regarding future research needs are also presented.
DTIC
Composite Materials; Electromagnetic Interference; Electromagnetic Shielding; Nanostructures (Devices); Surveys

20100020263 Lehigh Univ., Bethlehem, PA USA
Design Limits for Precast Concrete Sandwich Walls Subjected to External Explosions (PREPRINT)
Nalto, Clay; Beacraft, Mark; Hoemann, John; February 2010; 13 pp.; In English; NASCC: The Steel Conference and the 2010 Structures Congress, 12-15 May 2010, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): FA4819-09-C-0032; Proj-4918; 62012F
Report No.(s): AD-A518887; AFRL-RX-TY-TP-2010-0013; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518887

The use of precast/prestressed concrete and tilt-up concrete for exterior walls is common practice in the USA. This form of construction provides an economical, rapid, and high quality building technique making it ideal for military and government facilities. In most cases these building systems must be designed against a potential explosive demand. Current design recommendations are very restrictive when using precast concrete components due in large part to the lack of experimental research data. To address this issue, a series of over 50 experiments were conducted to assess the failure modes and load and deformation capacity of wall panel systems. Single span and multispan panels were examined. Foam type, tie type, and reinforcement were varied to provide a thorough understanding of the effects of these variables on the failure modes of the panels. The response of the systems was found to be sensitive to the insulation foam used and the failure mode of the shear ties. The results indicate that insulated precast concrete panels exceed the current response limits used by the Army for Anti-Terrorism and Force Protection (ATFP) applications.
DTIC
Blast Loads; Concretes; Design Analysis; Explosions; Prestressing; Sandwich Structures; Walls

20100020298 Universal Technology Corp., Dayton, OH USA
Collaborative Research and Development (CR and D) Delivery Order 0046: Structure-Processing-Property Relationships of Adaptive Polymer Nanocomposites
Koerner, Hilmar; November 2007; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-03-D-5801-0046; Proj-4349; 62102F
Report No.(s): AD-A519724; S-531-046; AFRL-RX-WP-TM-2010-4126; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted

at Wright-Patterson AFB, Ohio. This research developed methods to fabricate polymer nanocomposites and determined the structure-processing-property relationships to enable optimization of polymer nanocomposites with adaptive mechanical and electromagnetic properties for future UAV systems.
DTIC
Carbon Nanotubes; Composite Materials; Nanocomposites; Nanostructures (Devices); Pilotless Aircraft; Polymers; Polyurethane Resins; Thermoplasticity

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*; and *44 Energy Production and Conversion*.

20100019519 Princeton Univ., NJ, USA
Comprehensive Mechanisms for Combustion Chemistry: An Experimental and Numerical Study with Emphasis on Applied Sensitivity Analysis
Dryer, F. L.; Apr. 10, 2009; 196 pp.; In English
Contract(s)/Grant(s): FG02-86ER13503
Report No.(s): DE2010-951070; DOE/86ER13503-14; No Copyright; Avail.: National Technical Information Service (NTIS)

This project was an integrated experimental/numerical effort to study pyrolysis and oxidation reactions and mechanisms for small-molecule hydrocarbon structures under conditions representative of combustion environments. The experimental aspects of the work were conducted in large-diameter flow reactors, at 0.3 to 18 atm pressure, 500 to 1100 K temperature, and 10-2 to 2 seconds reaction time. Experiments were also conducted to determine reference laminar flame speeds using a premixed laminar stagnation flame experiment and particle image velocimetry, as well as pressurized bomb experiments. Flow reactor data for oxidation experiments include: (1) adiabatic/isothermal species time-histories of a reaction under fixed initial pressure, temperature, and composition; to determine the species present after a fixed reaction time, initial pressure; (2) species distributions with varying initial reaction temperature; (3) perturbations of a well-defined reaction systems (e.g. CO/H2/O2 or H2/O2) by the addition of small amounts of an additive species. Radical scavenging techniques are applied to determine unimolecular decomposition rates from pyrolysis experiments.
NTIS
Combustion; Combustion Chemistry; Sensitivity Analysis

20100019878 Naval War Coll., Newport, RI USA
China's Oil Security Pipe Dream: The Reality, and Strategic Consequences, of Seaborne Imports
Erickson, Andrew S; Collins, Gabriel B; Jan 2010; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519354; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Between now and 2025 the world's major economies will likely still depend to a large degree on traditional energy sources. Oil and liquefied natural gas (LNG) are the two with inherent naval significance, as they must be transported by sea to the extent that domestic supplies or overland pipelines are insufficient. Indeed, maritime transport is almost always significantly cheaper than any overland alternatives. Private-sector analysts have produced detailed forecasts of supply and demand for these two critical commodities. But no researchers have yet produced a detailed study of the strategic and naval implications of Chinese energy access. The market focus of energy intelligence firms and the lack of security and technical information informing journalists in the energy field have so far precluded analysis of the issue. The National Intelligence Council's Global Trends 2025 report projects a still-preeminent U.S. joined by fast developing powers, notably India and China, atop a multipolar international system that will be subject to an increased likelihood of conflict over scarce resources-one of them being energy. This article assesses the relative dependence of China (as a consumer) on seaborne oil flows between now and 2025. China is now the world's second-largest oil user. It now imports half of its crude oil. Seaborne imports, which overland pipelines will not reduce, constitute more than 80 percent of this total. China's oil security concerns will help shape its military and policy priorities fundamentally, with significant implications for the U.S. Navy in coming years. Chinese security analysts and policy makers worry about their nation's excessive reliance on seaborne oil shipments. For the present, it underscores a question of fundamental importance concerning China's strategic orientation: To what extent

will China seek to transform itself from a continental to a continental-maritime power?
DTIC
China; Fuel Oils; Navy; Oils; Pipes (Tubes); Security

20100019879 Defense Energy Support Center, Fort Belvoir, VA USA
Defense Energy Support Center Fact Book, Fiscal Year 2008, Thirty-First Edition
Jan 2009; 116 pp.; In English
Report No.(s): AD-A519360; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Defense Energy Support Center Fact Book contains information regarding the Center's business operations. The Fact Book reflects the Center's operational status at the end of fiscal 2008 (FY08) unless otherwise indicated. The Center's mission is to provide the Department of Defense and other government agencies with comprehensive energy solutions in the most effective and economical manner possible.
DTIC
Defense Program; Fuels; Logistics Management; Petroleum Products

20100019954 Drexel Univ., Philadelphia, PA USA
The Preignition and Autoignition Oxidation of Alternatives to Petroleum Derived JP-8 and their Surrogate Components in a Pressurized Flow Reactor and Single Cylinder Research Engine
Kurman, Matthew S; Sep 2009; 118 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0070; W911NF-07-1-0522
Report No.(s): AD-A519528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Samples of jet fuel derived from coal, natural gas, and petroleum were oxidized in two complementary experimental facilities to explore their preignition and autoignition behavior. In both facilities, the order of reactivity, based on carbon monoxide production. in descending order was Fischer-Tropsch, petroleum, and coal. The reactivity differences are attributed to composition differences. Results showed that all the fuels exhibit negative temperature coefficient behavior as expected, but Fischer-Tropsch jet fuel produces significantly more carbon monoxide than petroleum and coal derived jet fuel before entering the negative temperature coefficient region. Possible surrogates and their components were also tested in the facilities to elucidate how compositional differences affect preignition and autoignition chemistry. A mixture of n-decane I iso-octane was studied as a surrogate fuel for Fischer-Tropsch jet fuel. The mixture was then tuned to approximate the low and intermediate temperature reactivity of Fischer-Tropsch jet fuel. Fischer-Tropsch jet fuel and the mixture showed similar reactivity based on measurements of carbon monoxide. PFR experiments for n-decane and decalin were also conducted to identify intermediate species profiles using gas chromatography with flame ionization detection and gas chromatography coupled to a mass spectrometer.
DTIC
Alternatives; Crude Oil; Ignition; Internal Combustion Engines; Jet Engine Fuels; JP-8 Jet Fuel; Oxidation; Spontaneous Combustion

20100020220 Defense Threat Reduction Agency, Fort Belvoir, VA USA
A New Era in Combating WMD
Tegnelia, James A; Jan 2007; 3 pp.; In English
Report No.(s): AD-A519825; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The President's National Strategy to Combat Weapons of Mass Destruction describes such weapons in the hands of hostile states and terrorists as one of the greatest security challenges facing the USA. This strategy reinforces the need for the Department of Defense (DoD) to continue developing an integrated and comprehensive approach to counter the weapons of mass destruction (WMD) threat. As an essential step toward that approach, the Secretary of Defense assigned the commander, U.S. Strategic Command (USSTRATCOM), as the lead combatant commander for integrating and synchronizing DoD efforts in combating WMD. The President further codified responsibilities and authorities assigned to the USSTRATCOM commander in the Unified Command Plan of May 5, 2006. In answer to this assignment, the commander established the USSTRATCOM Center for Combating Weapons of Mass Destruction (SCC-WMD), which is collocated with the Defense Threat Reduction Agency (DTRA) at Fort Belvoir, Virginia. To support this vital mission further, the Secretary of Defense dual-hatted the director of DTRA as the director of the SCC-WMD. At the strategic level, preventing hostile states and nonstate actors from acquiring or using WMD is one of the four priorities identified in the 2006 Quadrennial Defense Review. Also at the strategic level, the Chairman of the Joint Chiefs of Staff on February 13, 2006, issued the first-ever National

Military Strategy to Combat Weapons of Mass Destruction. As defined in the national military strategy, the three pillars are Nonproliferation, Counterproliferation, and Consequence Management. At the next level, the national military strategy identifies eight mission areas that span the pillars in the national strategy: offensive operations, elimination, interdiction, active defense, passive defense, consequence management, security cooperation and partner activities, and threat reduction cooperation.
DTIC
Center of Mass; Command and Control; Countermeasures; Defense Program; Destruction; Military Operations; Strategy

20100020321 Air Force Research Lab., Wright-Patterson AFB, OH USA
National Aerospace Fuels Research Complex
Edwards, Tim; March 2010; 28 pp.; In English
Contract(s)/Grant(s): Proj-3048; 62203F
Report No.(s): AD-A519334; AFRL-RZ-WP-TR-2010-2078; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes extensive in-house research performed by the Air Force Research Laboratory/ Propulsion Directorate Fuels Branch for the 2000-2009 time period under in-house work unit 304805F1. This work was organized under the organizational umbrella of the National Aerospace Fuels Research Complex (NAFRC). This in-house work unit is a successor/consolidation to a number of in-house work units, such as 30480537, 30480587, 2308P700, and is the predecessor to 5330SBF1. This work unit covered the time period from 2000-2009, and includes all the in-house efforts supporting the Fuels Branch of the AFRL Propulsion Directorate. The major on-site contract support was provided by the University of Dayton Research Institute through contracts F33615-97-C-2719 and F33615-03-2-2347. Approximately 60 on-site contractors work on this in-house program as of March 2010. This summary includes a general description of the in-house work areas--a more complete description will be found in the final report for F33615-03-2-2347, forthcoming in early 2011. Areas discussed in some detail include endothermic fuels, fuel hydrocarbon class analysis, and jet fuel naphthalene analysis.
DTIC
Fuels; Jet Engine Fuels; Military Technology; Research and Development

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20100018398 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies
Chen, Shi-Shuenn, Editor; Chu, Jinn P., Editor; Jou, Shyan-kay, Editor, et al.; January 2010; ISSN 02533839; 146 pp.; In English; See also 20100018399 - 20100018413; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Topics covered include: The Flow Rectification of a Vaned Microdiffuser: A Numerical Investigation; A Microfluidic System with Non-Embedded Tilting Inter-Castellated Electrode for Dielectrophoretic Separation; Using MEMS Sensors in the Bridge Scour Monitoring System; The Development of an 8 x 8 Optical Switch; A Simple, Flexible and Economical Microelectrode Fabricated on Printed Circuit Board for Extracellular Cortical Recording of Rat; The Influence of the Bias Type, Doping Condition and Pattern Geometry on AFM Tip-Induced Local Oxidation; Tip Profile Estimation of Scanned Probe Microscopy for Micro and Nano Surface Roughness Measurement; The Development of a 3-Dimensional Vibration Measuring System with Corner Cubes and Quadrant Detectors; Precision Recovery Fabrication Using a Cylinder-Form Tool; An Intelligent System of Catalyst Layer Deposition for Proton Exchange Membrane Fuel Cell; A Novel Synthesis of Highly Ordered P-SBA-15 Mesoporous Materials; Catalytic Activity of Ag-Pd Nanoparticles Prepared by N2H4 Reduction in Electroless Nickel Deposition; Effects of Ultrasonic Diffuse Field on Particle Dispersion in Liquid; Manufacturing Parts Optimization in the Three-Dimensional Printing Process by the Taguchi Method; and Comparative Study on the Gain of a Tracking Panel According to Different Radiation Sources.
Author
Circuit Boards; Electroless Deposition; Microelectromechanical Systems; Printed Circuits; Vibration; Surface Roughness; Attitude (Inclination); Catalytic Activity; Cubes (Mathematics); Microfluidic Devices

20100018400 National Kaohsiung Univ. of Applied Sciences, Kaohsiung, Taiwan, Province of China

Catalytic Activity of Ag-Pd Nanoparticles Prepared by N2H4 Reduction in Electroless Nickel Deposition

Lee, Chien-Liang; Tseng, Chun-Ming; Wu, Chen-Chung; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 105-109; In English; See also 20100018398

Contract(s)/Grant(s): NSC 98-222 1-E- 15J-033; Copyright; Avail.: Other Sources

In this study we report on the catalytic activities of Ag/Pd alloy nanoparticles in electroless nickel deposition (END). The Ag/Pd nanoparticles were prepared by N2H4 reduction. Three types of Ag/Pd alloy nanoparticles were prepared from the simultaneous reduction of coexisting Ag and Pd ions in an aqueous solution of sodium dodecyl sulfate (SDS)/N2H4. The particle sizes of the three types of bimetallic nanoparticles in the SDS bath maintained at a controlled temperature were found to be near equal. The result of energy dispersive X-ray and UV-Vis spectroscopy measurement indicate that the distribution of Ag atom in the structure of the bimetallic nanocatalysts increases with the C(sub Ag)(+)/C(sub Pd)2(+) ratio. Quartz crystal microgravimetry results reveal that the activities of the Ag(sub 10)/Pd(sub l), Ag(sub l)/Pd(sub 1), and Ag(sub l)/Pd(sub 10) nanoparticles are 2.55 x 10(exp -3) cm(exp -2) (raised dot) s(exp -1), 1.0 x 10(exp -2) (raised dot) s(exp -1) and 3.04 x 10(exp -3) cm(exp -2) (raised dot) s(exp -1), respectively.

Author

Catalytic Activity; Electroless Deposition; Nanoparticles; Nickel; Palladium Alloys; Bimetals; Silver Alloys

20100018401 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Manufacturing Parts Optimization in the Three-Dimensional Printing Process by the Taguchi Method

Hsu, Tsung-Jung; Lai, Wei-Hsiang; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 121-130; In English; See also 20100018398; Copyright; Avail.: Other Sources

The functional requirements of three-dimensional printing systems are speed, accuracy and the strength of the green-part. However, these functional indices are significantly affected by the properties of the adopted materials and the manufacturing process parameters of the rapid prototyping machine. The four most important process parameters were systematically investigated in this study. Using the ANOVA analysis techniques of the Taguchi method and adjusting the shrinkage setup value, we determined the optimal parameter setup values for NCKU-1 powder and reduced the dimensional accuracy error to plus or minus 0.08 mm, plus or minus 0.07 mm and plus or minus 0.06 mm in the X-, Y- and Z-direction, respectively. The results also show that these optimized parameters can shorten building time by 9.57% and increase flexural stress by 31.27%. Finally, the quality properties were also examined separately for ZP 100 and NCKU-1 powder. It is concluded that building time decreased by 16.5%, binder consumption was reduced by 35.4% and flexural stress increased 172.88% if the powder was changed from ZP 100 to NCKU-1.

Author

Manufacturing; Optimization; Taguchi Methods; Printing; Three Dimensional Models; Powder (Particles)

20100018403 Tatung Univ., Taipei, Taiwan, Province of China

A Microfluidic System with Non-Embedded Tilting Inter-Castellated Electrode for Dielectrophoretic Separation

Wei, Chehung; Liang, Cheng-Hao; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 15-23; In English; See also 20100018398

Contract(s)/Grant(s): NSC 97 -22 12-E-036-02 1; B97-M08-036; Copyright; Avail.: Other Sources

A dielectrophoretic (DEP) separation dev ice with non-embedded intercastellated electrode design is proposed. The dielectrophoretic force is enhanced by a tilting electrode where an electric field gradient along the flow direction is generated. The maximum strength of the electric field is reached at the outlet where the separation occurs. Yeast cells with different dielectric properties (viable vs. non-viable) were used to study the separation efficiency under different operation conditions. The effect of medium conductivity on the DEP spectrum was modeled by a smear-out sphere model for yeast cells. The results show that low medium conductivity has high DEP force and is advantageous for separation. The number of collected yeast cells was calculated based on spectrophotometer readings. The optimal collection frequencies for viable and non-viable cells are 10 MHz and 5 MHz, respectively. The different DEP characteristics for viable and non-viable cell is the primary reason for such a discrepancy. Good collection efficiency in yeast cells shows that a non-embedded tilting intercastellated electrode is an efficient way to separate different dielectric property materials.

Author

Attitude (Inclination); Dielectric Properties; Electric Fields; Spectrophotometers; Microfluidic Devices

20100018404 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

The Flow Rectification of a Vaned Microdiffuser: A Numerical Investigation

Sun, Chen-Li; Lin, Gu-Chiuan; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 1-13; In English; See also 20100018398

Contract(s)/Grant(s): NSC 94-22 12-E-O 11 -039; NSC NSC 95-222 I-E-0 11- 160; Copyright; Avail.: Other Sources

This paper presents a numerical investigation to characterize the flow rectification of a dynamic vaned microdiffuser pump. To study the impacts of vane configuration in microscale, two vanes stretching from the inlet region to the outlet region are added to divide the microdiffuser into three flowing passages. By imposing a sinusoidal pressure at the inlet, two geometric parameters are considered: half angle of the diverging section theta and half angle between adjacent vanes phi. We find that when the angle between adjacent vanes remain the same (fixed theta), net flow rate is augmented with increasing phi. In contrast, there exit an optimized vane configuration while the diverging section is unchanged (fixed phi). For theta < phi/3, increase in theta helps to improve flow rectification. For theta > phi/3, further increase of theta results in narrower side passages, and net flow rate diminishes consequently. Hence, best flow rectification is achieved when the diverging section is equally divided by the vanes, i.e. theta = phi/3. The influences of vane configuration in flow rectification can be categorized into three regimes: central passage dominated, best rectification, and side passage dominated.
Author

Rectification; Sine Waves; Flow Velocity; Vanes

20100018405 National Center for Research on Earthquake Engineering (NCREE), Taipei, Taiwan, Province of China

Using MEMS Sensors in the Bridge Scour Monitoring System

Lin, Yung-Bin; Lai, Jihn-Sung; Chang, Kuo-Chun; Chang, Wen-Yi; Lee, Fong-Zuo; Tan, Yih-Chi; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 25-35; In English; See also 20100018398

Contract(s)/Grant(s): 06097 Al 004; Copyright; Avail.: Other Sources

Scour failures tend to occur suddenly and without warning. Hydraulic scouring is one of the major factors in bridge failure. Bridges that are subject to periodic flooding should be monitored during high-flow seasons for the safety of the public. Wireless sensor networks have been applied widely, and in many fields. In this study, micro-electro-mechanical system (MEMS) pressure sensors are integrated with the wireless Zigbee network on a sensor board for real-time bridge scour monitoring. A wireless MEMS scour monitoring system has been developed and tested in the laboratory. This system can measure the scouring/deposition process and the variations of water level at a bridge pier. A scour model is employed to calculate the scour-depth evolution and validated with real-time measured data. The results indicate that the proposed system has potential applicability to monitor scour evolution in the field.
Author

Microelectromechanical Systems; Wireless Communication; Topology; Hydraulic Equipment; Mathematical Models; Pressure Sensors

20100018406 National Cheng Kung Univ., Tainan, Taiwan, Province of China

The Development of a 3-Dimensional Vibration Measuring System with Corner Cubes and Quadrant Detectors

Chen, Shang-Liang; Jywe, Wen-Yuh; Hsieh, Tung-Hsien; Liu, Chien-Hung; Huang, Hsueh-Liang; Hsu, Tung-Hui; Jeng, Yeau-Ren; Wang, Ming-Shi; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 71-80; In English; See also 20100018398

Contract(s)/Grant(s): NSC 93-2212-E-150-036; NSC 94-2622-E-150-00; Copyright; Avail.: Other Sources

In this paper, a new optical 3-dimensional vibrometer is presented. This system is composed of two orthogonally set up corner cubes (CC), a collimated laser source, two quadrant detectors (QD) and three beam-splitters (BS). The corner cubes are designed to be fixed to the vibrating object and reflect the laser source onto the quadrant detector. Due to the optical characteristics of the corner cubes, the measuring results of the QD can be magnified twice and it is not affected by micrometer-angle. So, the three-dimensional vibration amplitude can be obtained. The resolution is about 50 nm. This system is characterized by three-dimensional measurement, high resolution, low cost, simple set up and wide bandwidth.
Author

Bandwidth; Beam Splitters; High Resolution; Vibration Meters; Optical Properties; Laser Outputs; Cubes (Mathematics)

20100018407 Tungnan Univ., Taipei, Taiwan, Province of China

The Influence of the Bias Type, Doping Condition and Pattern Geometry on AFM Tip-Induced Local Oxidation

Huang, Jen-Ching; Tsai, Chin-Lin; Tseng, Ampere A.; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 55-61; In English; See also 20100018398

Contract(s)/Grant(s): NSC 98-2221-E-236-006; Copyright; Avail.: Other Sources

In this article, the influences of bias types, doping condition, and pattern geometry on the kinetics of oxides on Si substrates produced by AFM tip-induced local oxidation were investigated. The growth height of oxides using a +10V sample bias is higher than that when using a -10V tip bias, while the magnitude of sample-tip bias is kept the same. A polygon concept was introduced to produce a circular pattern. The effect of the number of sides in the polygon on the height of oxide circular pattern were explored. It was observed that the oxide height increased with the number of sides of the polygon pattern when the radius is the same. And the oxide is higher on p-Si(100) than on p-Si(111) or n-Si(111).

Author

Bias; Polygons; Oxides; Substrates; Oxidation; Additives

20100018408 Nankai Univ., Tiangjin, China

Comparative Study on the Gain of a Tracking Panel According to Different Radiation Sources

Chang, Tian-Pau; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 131-139; In English; See also 20100018398; Copyright; Avail.: Other Sources

The utilization of solar energy has become very popular, currently. due to shortage of fossil fuels, and how to collect more energy is always an important issue for engineers. This paper presents a comparative study on the performance of a solar collector mounted on an idealized single axis Sun-tracking system. To simulate different operational environments, three types of radiation sources will be taken into account, i.e. extraterrestrial radiation, global radiation predicted by an empirical model and global radiation observed. Relevant expressions used for calculating the radiation are derived. The simulation results show that the incident angle of sunlight upon a tracked panel remain nearly a constant value within a day and is always smaller than upon a traditionally fixed panel except at solar noon. As compared to the fixed panel, the tracked panel may achieve more significant gain at times close to dawn or dusk. For the study site in Taichung, Taiwan, the daily gain during the autumnal equinox is 49.7%, 27.8% and 21.8% for the case of the extraterrestrial, predicted and observed radiation, respectively, while the yearly gain is 51.2%, 28.5% and 18.7%, respectively. It is anticipated that the captured irradiation increases with rotation angle of tracked panel , but the benefit of increasing the rotation angle under overcast conditions is not as good as under a clear sky. With 50deg of the maximum rotation angle, the tracked panel makes the gains of about 51.2%. 28.5% and 18.7% for the extraterrestrial, predicted and observed data, respectively, which gains are consistent with other studies.

Author

Radiation Sources; Extraterrestrial Radiation; Energy Technology; Irradiation; Solar Energy Conversion

20100018409 National Taipei Univ. of Technology, Taipei, Taiwan, Province of China

A Simple, Flexible and Economical Microelectrode Fabricated on Printed Circuit Board for Extracellular Cortical Recording of Rat

Yu, Yao-Ming; Lo, Rong-Chin; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 45-53; In English; See also 20100018398; Copyright; Avail.: Other Sources

An implanted microelectrode is the first piece of hardware in the extracellular neural signal-recording pathway. This work presents a simple, flexible and economical microwire array electrode for extracellular cortical recordings. The materials include Teflon insulated tungsten microwires, a printed circuit board pattern, a flexible flat cable and connector and viscose epoxy A+B. The proposed procedure is relatively simple, even for a novice worker to implement in-house. These main steps include design and sculpting a printed circuit board, straightening microwires, connecting printed circuit board patterns, arraying and soldering microwires and packaging the microelectrode. In this study, we apply electro chemical impedance spectroscopy to measure the impedance and the phase between the electrode and the electrolyte, and then to obtain an equivalent circuit. The presented microwire array electrode is successfully adopted to record an extracellular cortical signal. The proposed microwire array electrode can be designed and revised for multi-site, multiple single-unit or particular recording experiments

Author

Circuit Boards; Epoxy Resins; Equivalent Circuits; Printed Circuits; Electrodes; Impedance

20100018410 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Tip Profile Estimation of Scanned Probe Microscopy for Micro and Nano Surface Roughness Measurement

Chen, Jr-Rung; Chen, Chao-Chang A.; Liou, Huay-Chung; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 63-70; In English; See also 20100018398; Copyright; Avail.: Other Sources

Tip profile estimation is essential for tracing and calibrating surface roughness measurements either for conventional surface roughness measurement or for scanning probe microscopy (SPM), especially atomic force microscopy (AFM). This paper presents a tip profile estimation method, called the stylus tip reconstruction method (STRM), which is based on set-theory and the convolution method, which determines the calibrated grating gage for nano surface roughness measurement. A micro-STRM has been implemented first on a surface roughness analyzer with a tip of radius 5 micrometers for measuring a traced roughness gage having a step height of 10 micrometers and a razor blade with the ISO 5436 standard. Experimental results in the micro scale tests show that the residual of the micro-STRM with the step gage and razor blade measurement is around 4%. Then in a nano scale test, AFM was configured to verify the developed nano-STRM. The tip profile calculated by the nano-STRM was obtained and verified by a scanning electron microscopy (SEM) image. The developed STRM has been verified for micro and nano surface roughness measurement for tip profile estimation. Further application of the developed STRM can be used in compensating for measured images in micro and nano surface roughness measurement. . Author

Measuring Instruments; Atomic Force Microscopy; Calibrating; Surface Roughness; Razor Blades; Scanning Electron Microscopy

20100018412 Cheng-Shiu Univ., Taiwan, Province of China

Effects of Ultrasonic Diffuse Field on Particle Dispersion in Liquid

Huang, Yi-Cheng; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 111-119; In English; See also 20100018398

Contract(s)/Grant(s): NSC 93-22 12-E-23 0-005; Copyright; Avail.: Other Sources

This work presents a noncontact method for dispersing particle in liquid that is based on the acoustic radiation force that is produced by a sound wave incident at an inclined angle on the particles. The relation of the incident angle and the intensity for optimally dispersing Al2O3 particles in water is investigated. Experimentally, the maximum ultrasonic intensity of 9V in each incident angle did not disperse the most particles. Hence, an ultrasonic field of proper intensity is suggested to optimize the dispersion of particles.

Author

Ultrasonics; Dispersions; Particle Theory; Optimization; Irradiation

20100018413 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

A Novel Synthesis of Highly Ordered P-SBA-15 Mesoporous Materials

Vetrivel, Shanmugam; Lin, Yun-Chih; Pan, Chun-Jern; Cheng, Ming-Yao; Hwang, Bing-Joe; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 99-103; In English; See also 20100018398

Contract(s)/Grant(s): NSC 97-2 120-M-O I 1-001; Copyright; Avail.: Other Sources

A simple synthesis method is presented to prepare highly ordered novel P-SBA-15 materi als, which can provide additional Broensted acid sites for potential applications in catalysis. The developed materials have been unambiguously characterized by various technique such as SAXS, nitrogen physisorption, SEM, TEM, 31PNMR and FT-IR spectroscopy. The SAXS and TEM results revealed well-ordered hexagonal arrays of mesoporous materials. 31PNMR and EDS results confirmed the incorporation of phosphorous in the SBA-15 network. The method can provide an efficient way to synthesize high phosphorous content mesoporous silica with ordered structure.

Author

Silicon Dioxide; Composite Materials; Synthesis (Chemistry); Acids; Hydrothermal Systems; Phosphorus; Nuclear Magnetic Resonance; Transmission Electron Microscopy

20100018659 Physikalisch-Technische Bundesanstalt, Brunswick, Germany

Time Transfer Through Optical Fibers (TTTOF): First Results of Calibrated Clock Comparisons

Piester, Dirk; Fujieda, Miho; Rost, Michael; Bauch, Andreas; Nov 2009; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517803

We have developed a means for accurate time transfer using optical fibers and aim at the synchronization of clocks located at different places on an institute campus with an overall uncertainty of 100 ps or better. Such an installation shall be used as a part of the infrastructure connecting the ground station setups during forthcoming T2L2 and ACES experiments and the local installations at the PTB time laboratory. Our target transmission length is less than 1 km. To transfer time, a code-domain-multiple-access (CDMA) signal is used for modulation of a laser. Optical signals are exchanged in the two-way mode to cancel long-term fiber length variation. This is similar to the well known two-way satellite time and frequency transfer (TWSTFT) scheme. We discuss procedures for a proper calibration of such time transfer through optical fibers links and show first promising results of an experiment using a test loop on the PTB campus with a length of 2 km.

DTIC

Calibrating; Clocks; Fiber Optics; Frequencies; Optical Fibers

20100018670 Bureau International des Poids et Mesures, Sevres, France

Use of GLONASS at the BIPM

Lewandowski, W; Jiang, Z; Nov 2009; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517828; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517828

The Russian Navigation Satellite System (GLONASS) provides interesting opportunities for international time metrology. The GLONASS constellation is now in the final stages of construction and can already be used for international time transfer. At least 19 national time laboratories are now equipped with the most recent GPS/GLONASS time receivers. The BIPM collects data from these receivers and is now publishing related time links. GLONASS links are now compared on a regular basis to GPS links and will also soon be compared to TWSTFT links. This paper reports the latest results from the BIPM.

DTIC

GLONASS; Navigation Satellites

20100018672 Analytical Graphics, Inc., Exton, PA USA

Optimal Time Transfer

Wright, James R; Woodburn, James; Nov 2009; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517832; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517832

We have designed an optimal time transfer algorithm using GPS carrier-phase and pseudorange measurements. This will enable the near-real-time estimation of the difference between the phase of a stable real-time UTC ground clock attached to a GPS ground receiver and the phase of each NAVSTAR spacecraft clock in the ensemble of GPS spacecraft. We propose a master filter (MF) to drive multiple instances of spawned filters (SF) and fixed-epoch smoothers (FES). The MF is designed to map all GPS carrier-phase measurement information of each GPS ground-station/NAVSTAR pass into the complete MF state estimate of all NAVSTAR parameters and all station parameters, with all serial correlations and all cross-correlations accounted for. Each SF runs forward with time while the FES linearly maps measurement information backwards to fixed epochs for individual NAVSTAR spacecraft. FES estimates are then folded into the MF as pseudo-measurements. The resulting time-transfer algorithm is an autonomous forward-running sequential estimator, with no state-sized matrix inverse calculations required.

DTIC

Algorithms; Global Positioning System; Navigation Satellites

20100018686 Physikalisch-Technische Bundesanstalt, Brunswick, Germany

PTB's Primary Clock CS1: First Results After Its Reconstruction

Bauch, Andreas; Brand, Harald; Heindorff, Thomas; Fischer, Bernd; Schroder, Roland; Dec 1996; 9 pp.; In English

Report No.(s): AD-A517878; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517878

The paper describes the reconstruction of PTB's primary clock CSI and gives first results obtained. In view of the

important role of the CSI among the primary clocks within the international network of timing laboratories, a short look to its history is also given.
DTIC
Atomic Clocks; Clocks; Frequency Standards; Global Positioning System; Time Measurement

20100018695 National Inst. of Advanced Industrial Science and Technology, Ibaraki, Japan
Study of Frequency Transfer via Optical Fiber in the Microwave Domain
Amemiya, M; Imae, M; Fujii, Y; Suzuyama, T; Watabe, K; Ikegami, T; Tsuchida, H; Nov 2009; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517905; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517905

Technical issues are investigated for a precise frequency transfer system using two-way signals by wavelength division multiplexing (WDM) in a single fiber. Bi-directional optical amplifiers are necessary to make the distance longer. Frequency stability is shown in the tandem optical amplifier link where the amplified spontaneous emission (ASE) noises are accumulated. Increasing transmission speed is effective for improving the system performance; however, chromatic dispersion of the fiber degrades the frequency stability significantly in an experiment with 10 GHz signal and 50-km fiber. The degradation can be improved by using 1550 nm zero-dispersion-shifted fiber (DSF) instead of SMF. Effects of polarization mode dispersion (PMD) and polarization scrambling are experimentally shown with a differential group delay (DGD) generator. It is also important to use stable oscillators for stability evaluation, since the time difference between the original and the received signal at the far end degrades the performance if the phase noise of the OSC source is not small enough.
DTIC
Fiber Optics; Frequencies; Microwaves; Optical Fibers

20100018749 SP Technical Research Inst. of Sweden, Boras, Sweden
Time and Frequency Activities at SP in Sweden
Jaldehag, K; Rieck, C; Ebenhag, S -C; Nov 2009; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518037; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518037

The national time and frequency laboratory of Sweden has since 1995 been a part of the measurement technology department at the SP Technical Research Institute of Sweden. The laboratory is responsible for maintaining a realization of Swedish standard time and the dissemination of this time scale in Sweden. The objective of the laboratory is to support and supply Swedish industry and authorities with accurate measures of time and frequency by instrument calibration, knowledge transfer, time dissemination, and research and development. Swedish standard time is connected by law to UTC as maintained by the BIPM. UTC (SP) is the realization of UTC in Sweden and is traceable to UTC via BIPM and time transfer using the GPS and TWSTFT techniques. This paper describes the generation and maintenance of UTC (SP) and the equipment, including clocks and time transfer equipment, needed for this task as well as the concept of a Distributed Time Scale using alternate versions of UTC (SP) maintained at sister laboratories in Sweden. The paper presents also activities related to the dissemination of Swedish standard time including GPS time transfer, Network Time Protocol (NTP), telephone time code, and a speaking clock. Finally, research activities including time transfer in optical fiber networks, continuous GNSS carrier-phase processing, and Kalman-filter-based ensemble clock generation are briefly presented.
DTIC
Frequencies; Protocol (Computers); Sweden

20100018750 Naval Observatory, Washington, DC USA
Time and Frequency Activities at the U.S. Naval Observatory
Matsakis, Demetrios; Nov 2009; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518041; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518041

The U.S. Naval Observatory (USNO) has provided timing for the Navy since 1830 and, via DoD Directive 4650.05, is the sole source of timing for the Department of Defense. In cooperation with other institutions, the USNO also provides timing for the USA and the international community. Its Master Clock (MC) is the source of UTC (USNO), USNO's realization of Coordinated Universal Time (UTC), which has stayed within 5 ns rms of UTC since 1999 and within 3.9 ns rms in 2009. The data used to generate UTC (USNO) are based upon 60 cesium and 24 hydrogen maser frequency standards in four buildings

at two sites. USNO disseminates time via voice, telephone modem, LORAN, Network Time Protocol (NTP), GPS, and Two-Way Satellite Time Transfer (TWSTT). This paper describes some of the changes being made to meet the future needs for precision, accuracy, and robustness. Further details and explanations of our services can be found online at http://www.usno.navy.mil/USNO.
DTIC
Clocks; Frequencies; Observatories; Time Measurement

20100018758 Naval Research Lab., Washington, DC USA
Recent Timing Activities at the U.S. Naval Research Laboratory
Beard, Ronald; Oaks, O J; Senior, Kenneth; White, Joseph; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518056; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518056

The U.S. Naval Research Laboratory has a number of ongoing time and frequency programs. This paper provides an overview of work currently being done. The programs include GPS clock life testing and on-orbit analysis, Distributed Time and Frequency Systems, and iGPS. An update on UTC (NRL) is also presented.
DTIC
Global Positioning System; Time Measurement

20100018760 SP Technical Research Inst. of Sweden, Boras, Sweden
Time and Frequency Transfer Using Asynchronous Fiber-Optical Networks: Progress Report
Jaidehag, K; Ebenhag, S; Hedekvist, P O; Rieck, C; Loethberg, P; Nov 2009; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518064; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518064

SP Technical Research Institute of Sweden has since 2004 been running a project with the aim of performing time and frequency transfer using commercial asynchronous fiber-optical networks. The project is motivated by the need for an alternative and complementary time transfer method on a national basis with the goal of reaching accuracy and stability comparable to satellite-based methods. Previous results using an OC-192/STM-64 10-Gb/s packet over SONET/SDH network show that time transfer accuracy of the order of a few nanoseconds is possible on baselines exceeding 500 km. The method is based on passive listening on existing data traffic and the detection of certain bit sequences in the SDH frame headers continuously transmitted by the network routers. By using two-way time transfer, it is possible to estimate and compensate for symmetric delays in the optical fibers. The method relies on the fact that time-dependent residual delays are small or can be compensated for and constant residual delays can be calibrated. This paper briefly revises the method and presents new results in comparison with the GPS carrier-phase technique, with focus on residual effects due to temperature variations, which have been shown to have a significant impact on the stability and accuracy. It also discusses hardware miniaturizations, as well as new ideas for active time transfer using bit-sequence generators/transmitters in dedicated wavelength slots of the optical network. Finally, the use of a subset of the IEEE Standard 1588-2008 (Precise Time Protocol, PTP) for data transport is briefly discussed.
DTIC
Fiber Optics; Frequencies; Synchronism

20100018761 Symmetricom, Inc., Beverly, MA USA
The Common Time Module, a Robust Time Maintenance System
Dowd, Andrew; Garvey, R M; Nov 2009; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WP15P7T-08-C-V205
Report No.(s): AD-A518065; XA-CERDEC/C2/NJ; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518065

The Common Time Module (CTM) is being developed by Symmetricom with support from the US Army/CERDEC. The goal is to implement timing services for mobile systems that demand a high degree of reliability and precision. The system is based around a core module that implements a time and frequency server with provisions for legacy time protocols. To address the rigors of a mobile and dynamic environment, the CTM manages multiple connections to the common time reference (UTC-USNO). Either GNSS signals (GPS) or a network connection (IEEE-1588) can synchronize local time services. In addition, the CTM integrates a low-power atomic resonator for extended holdover capabilities. By dynamically

managing these technologies, the CTM can supply accurate time and frequency in a wide range of deployment scenarios. Furthermore, improvements in low-power technology such as Chip-Scale-Atomic-Clock (CSAC) will dramatically reduce power requirement, which is a significant advantage to mobile systems. Finally, this paper will examine how standardized IEEE-1588 network techniques will be applied to support redundancy with the CTM.
DTIC
Electronic Modules; Maintenance; Timing Devices

20100018763 Army Tank-Automotive Research and Development Command, Warren, MI USA
CATL (Cooperative Approval Tire List) Update
Vinkovich, Richard; Mar 25, 2010; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518071; TARDEC-20567RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518071
This briefing goes through changes in the CATL (Cooperative Approval Tire List).
DTIC
Acceptability; Tires

20100018765 SELEX Sistemi Integrati S.p.A, Rome, Italy
A Space Rubidium Pulsed Optical Pumped Clock - Current Status, Results, and Future Activities
Belloni, Marco; Battisti, A; Cosentino, A; Sapia, A; Borella, A; Micalizio, S; Godone, A; Levi, F; Calosso, C; Zuliani, L; Longo, F; Donati, M; Nov 2009; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518073; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518073
Since the year 2000, Selex Galileo activity on Space Frequency Standards has been pursuing the development of a Passive Hydrogen Maser (PHM), presently the primary clock of the Galileo Navigation Constellation. A consortium has been established in 2007 with one of the best scientific laboratories in the European Time-Frequency community: the Istituto Nazionale di Ricerca Metrologica - INRiM (I) in order to demonstrate that the POP technique is suitable for space applications. The name of the project, Maser POP, comes from a very promising technique studied and refined by INRiM in order to achieve performance close to that of a passive hydrogen maser, but with dimensions and power consumption closer to a rubidium clock. Under an Italian Space Agency ASI contract, a feasibility study has been completed in 2008 concerning the manufacture of a clock breadboard and the preliminary design of the three units composing the clock: Space Physics Unit, Optical Unit, and Electronic Unit. This paper summarizes the outcome of this study in terms of Breadboard (BB) results (where a frequency stability on the order of 1.2x10(-12)tau(-0.5) has been measured) and the critical areas that shall be correctly addressed for the project objective's full achievement. The development plan of the Maser POP is presented together with an overview of expected characteristics, in terms of mass and power consumption, realistically optimized taking into account the needs of the space market. A preliminary schedule is also presented concerning future activities aiming at the development of an Engineering Model (EM). This plan includes the qualification of the clock against the Galileo environmental requirements. Also, these further activities will be supported by the Italian Space Agency (ASI) in the frame of the Space Atomic Clock Development program.
DTIC
Atomic Clocks; Clocks; Rubidium

20100018766 All-Union Research Inst. for Physical and Radiotechnical Measurements, Mendeleevo, Russian Federation
Activities and Updates at the State Time and Frequency Standard of Russia
Domnin, Y; Koshelyaevsky, N; Kostromin, V; Krasovsky, P; Palchikov, V; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518074; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518074
As it was announced, a campaign on the State Time and Frequency Standard modernization is under realization. A new prototype of the primary Cs fountain standard with an uncertainty of 3x10(-15) is under metrological investigation, which is expected to be finished at the end of 2009. For today, we have two new ensembles each of four H-masers of type of CH1-75A with individual cavity auto-tuning systems. The whole instrumentation set includes distribution amplifiers, a frequency and time measuring system, and a real-time time scale generation and distributing system. All these instruments are installed in thermally and humidity controlled chambers. Typical temperature and relative humidity variations are well below 0.1 degrees

C and approximately 1% respectively. As a result, the frequency stability of the H-masers on a 1-day basis is about few parts in 10(16). The new remote clock comparison system consists of several multichannel dual-frequency GLONASS/GPS TTS-3 receivers. All receivers have been differentially calibrated relative to a portable receiver as part of a calibration campaign arranged by the BIPM. A TWSTFT station is under construction in VNIIFTRI. The closest main goal is to arrange a time link to PTB and NICT via the IS-4 satellite. The same instrumentation set (four H-masers, a frequency and time measuring system, and time transfer equipment) will be installed in secondary laboratories in Novosibirsk, Irkutsk, Khabarovsk, and Petropavlovsk Kamchatsky.
DTIC
Atomic Clocks; Frequency Standards; Russian Federation; Time Measurement

20100018767 Aerospace Corp., El Segundo, CA USA
Investigations into the Rb Clock's 2nd Harmonic Signal: A Status Report
Fathi, Gilda; Camparo, James; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518076; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518076

As commercial and military systems become ever more dependent on GNSS, it becomes vitally important to ensure the health of the system's spacecraft atomic clocks. Though a number of methodologies for monitoring clock integrity are now under study/discussion, all have particular strengths and weaknesses; no one methodology achieves the ideal. More than likely, future GNSS will ensure clock integrity through a hybrid of techniques, and one component of that hybrid will certainly focus on the clock's status-of-health monitors: rf-signal level, lock-monitor voltage (and for Rb clocks) cell temperature, lamp monitor voltage, and 2nd harmonic signal level. In the present work, we detail our preliminary investigations into the parameters that affect the 2nd harmonic signal.
DTIC
Atomic Clocks; Clocks; Harmonic Generations

20100018768 Aerospace Corp., Los Angeles, CA USA
A Glimpse of the Future: The 62nd PTTI Systems & Applications Meeting November 2030
Mallette, Leo A; Camparo, James C; Nov 2009; 11 pp.; In English
Report No.(s): AD-A518077; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518077

If the PPTI Systems & Applications Meeting is to thrive and grow, our community needs to consider the direction this conference should take as the 21st century proceeds. At a conference workshop, attendees attempted to assess our community's optimal appearance 20 years from now, and to develop plans to put the PTTI conference on a path to that future. Here, we review the major ideas brought up at the workshop. Specifically, after a brief review of some of the topics that have been of interest to the PTTI community over the past 20 years, attendees were asked to break into groups and brainstorm various views of a PTTI future. The task of these groups was threefold: 1) to predict the session and paper titles for the 62nd Annual PTTI Meeting -to be held in November 2030, 2) to list the impediments that could thwart realization of that conference, and 3) to imagine mitigation strategies that could remove those impediments. Junior and senior members of each group volunteered to further explore these ideas, and to present their thoughts/findings at next year's PTTI conference.
DTIC
Forecasting; Organizations

20100018769 Metas-Swiss Federal Office of Metrology and Accreditation, Bern-Wabern, Switzerland
METAS Time & Frequency Metrology Report
Bernier, Laurent-Guy; Stefanov, Andre; Schlunegger, Christian; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518078; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518078

METAS is the National Metrology Institute (NMI) for Switzerland. The Time & Frequency Laboratory (TFL) is responsible for the generation and dissemination of precise time and performs calibrations for customers. This paper reports on current or recent activities and international collaborations.
DTIC
Frequencies; Metrology; Switzerland; Time Measurement

20100018770 Johns Hopkins Univ., Laurel, MD USA

Time and Frequency Activities at the JHU Applied Physics Laboratory

Miranian, Mihran; Weaver, Gregory L; Reinhart, Matthew J; Dragonette, Richard A; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518079; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518079

The Time and Frequency Laboratory at the Johns Hopkins University Applied Physics Laboratory (JHL/APL) provides support to multiple current and upcoming NASA/APL missions that span our solar system from the study of the Sun's coronal mass ejections to the examination of the outer planets and the Kuiper Belt objects. This support includes providing precise time and frequency to the integration and testing of new hardware, frequency reference for spacecraft ranging and communications via the APL satellite communications facility, and the time-stamping of ground-receipt telemetry packets from various spacecraft. The Lab's ensemble of three high-performance cesium standards and three hydrogen masers are integrated to form the APL timescale, which is the basis for estimating UTC - UTC (APL) and for evaluating the performance of our clocks. Traceability to USNO, NIST, and UTC is maintained via GPS common-view and all-in-view time transfer. The Lab's clocks are also incorporated into the computation of International Atomic Time (TAI).

DTIC

Atomic Clocks; Frequencies; Research Facilities

20100018771 Naval Research Lab., Washington, DC USA

Clock Comparison Using Digital Television Signals

Boehm, Douglas; White, Joe; Mitchell, Stephen; Powers, Edward; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518080; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518080

The U.S. Naval Research Laboratory (NRL) and the U.S. Naval Observatory (USNO) have done precision clock comparison using an analog television signal as a common phase reference since the mid 1980s. With the demise of analog television in the USA, that method is no longer viable. A new technique has been developed using the pilot tone on the digital television signal. The system is currently running between NRL and USNO. This paper will present the design and show the performance achieved.

DTIC

Clocks; Digital Television; Television Systems; Video Signals

20100018772 National Inst. of Standards and Technology, Boulder, CO USA

Two-Way Satellite Time and Frequency Transfer Using 1 MChips/s Codes

Zhang, Victor; Parker, Thomas E; Achkar, Joseph; Bauch, Andreas; Lorini, Luca; Matsakis, Demetrios; Piester, Dirk; Rovera, Daniele G; Nov 2009; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518083; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518083

The Ku-band transatlantic and Europe-to-Europe two-way satellite time and frequency transfer (TWSTFT) operations used 2.5 MChip/s pseudo-random codes with 3.5 MHz bandwidth until the end of July 2009. The cost of TWSTFT operation is associated with the bandwidth used on a geostationary satellite. The transatlantic and Europe-to-Europe TWSTFT operations faced a significant increase in cost for using 3.5 MHz bandwidth on a new satellite. The use of 1 MChip/s pseudo-random codes with 2.5 MHz bandwidth was one of the alternatives for continuing the TWSTFT operations without the increase in cost. Two timing laboratories in the US and eight timing laboratories in Europe participated in an experiment from February to July of 2009 to study the 1 MChip/s TWSTFT performance. Based on the study results, the transatlantic and Europe-to-Europe TWSTFT operations switched to a new satellite using 1 MChip/s codes with 2.5 MHz bandwidth since 1 August 2009. In this paper, we report the performance of 1 MChip/s TWSTFT for the transatlantic and Europe-to-Europe links.

DTIC

Chips; Frequencies; Time Measurement

20100018792 Physikalisch-Technische Bundesanstalt, Brunswick, Germany

PTB's Time and Frequency Activities in 2008 and 2009

Rost, M; Bauch, A; Becker, J; Feldmann, T; Piester, D; Polewka, T; Sibold, D; Staliuniene, E; Nov 2009; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518139

The Physikalisch-Technische Bundesanstalt (PTB) maintains the German national time scale, disseminates time and frequency for both business and general public, and undertakes research to improve its facilities. This report covers the activities of PTB's Time Dissemination Working Group during 2008 and 2009. PTB's time scale UTC (PTB) is based on the primary clock CS2 and an associated phase micro-stepper to keep the time scale in reasonable agreement with UTC. CS2 and the other primary standards, CS1, CSF1, and CSF2, are part of PTB's ensemble of atomic clocks whose data are provided for the computation of TAI. During 2009, the commercial clocks have been moved step by step to a new clock room with improved operational conditions and state-of-the-art cabling. A broad range of satellite time-transfer equipment is being operated to enable time scale comparisons with other institutes all over the world. Single/multi-channel GPS receivers as well as so-called geodetic receivers enable frequency and time transfer with the state-of-the-art evaluation techniques (C/A code, P3, carrier phase, PPP). Two-way satellite time and frequency transfer (TWSTFT) is made routinely with several stations in Europe, the US, and Asia. Several calibration campaigns have been performed, partly with substantial support of USNO and BIPM, which allowed verification of the time-transfer uncertainty using PTB's current equipment. PTB provides services to disseminate time and frequency within Germany. The most prominent example is the low-frequency transmitter DCF77, which is widely used. In 2009, PTB looks back on 50 years operation of this service. Other time services are the NTP-servers as well as the telephone time service to synchronize computer via Internet or modem connection, respectively. The capability of the NTP infrastructure was enhanced by the introduction of an additional NTP server.

DTIC

Atomic Clocks; Frequencies

20100018804 Naval Research Lab., Washington, DC USA

Naval Research Laboratory Major Facilities 2008

Peachey, Claire; Parrish, Kathy; Oct 2008; 231 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518179; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518179

A directory of NRL's research facilities. The entry for each facility includes the function, a description, and a listing of the instrumentation used at the facility.

DTIC

Research Facilities

20100018805 Space and Naval Warfare Systems Center, Bremerton, WA USA

Storm Event Sampling in the Sinclair and Dyes Inlet Watershed: FY2005 Quality Assurance Project Plan

Johnston, R K; Brandenberger, J; May, C W; Whitney, V S; Wright, J M; Beckwith, Bruce; Pingree, Ryan; Jan 18, 2005; 67 pp.; In English

Report No.(s): AD-A518183; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518183

This document presents the 2005 storm-event sampling plan for the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (PSNS&IMF) Project ENVVEST. This plan has been prepared under the Project ENVVEST Final Project Agreement as a cooperative project among PSNS&IMF, the Environmental Protection Agency (EPA), and the Washington State Department of Ecology (Ecology), and technical stakeholders to help improve the environmental quality of the Sinclair and Dyes Inlet Watershed (US Navy, EPA and Ecology 2002). This sampling plan describes specific sampling activities to obtain data necessary to determine the loading and model the fate and transport of contaminants entering the receiving waters of Sinclair and Dyes Inlets (Table 1). This document identifies the objectives, procedures, and quality assurance/quality control (QA/QC) requirements for storm event sampling to be completed by Project ENVVEST for 2005. Upon completion of logistical planning and coordination with project participants and stakeholders, the 2005 sampling will commence in January 2005 and continue until sampling objectives are completed (June 2005). The major emphasis of the sampling will be to collect storm event samples from streams and storm water outfalls currently being monitored for flow within the watershed (Figure 1). Additional goals are to obtain data to support total loading and modeling analysis of contaminants discharged into Sinclair and Dyes Inlets, develop preliminary data on contaminant levels in nonpoint source

runoff in Gorst to evaluate the potential for developing restoration alternatives, and assess the impact of storm event runoff on the water quality of the Inlets. Also, in cooperation with Ecology's Manchester Environmental Laboratory (MEL), a subset of stream and selected storm water outfalls will be screened for pesticide and herbicide compounds.
DTIC
Drainage; Dyes; Ecology; Project Planning; Quality Control; Sampling; Storms; Water Quality

20100018916 National Inst. of Metrology, Beijing, China
Implementation and Comparison of Time and Frequency Transfer Methods by GPS Carrier Phase
Liang, Kun; Zhang, Aimin; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518427; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nowadays, GPS carrier-phase time and frequency transfer methods are applied more and more in the timing area because of their high ranging resolution, which corresponds to high time and frequency transfer precision. In this paper, we have built a GPS carrier-phase time and frequency transfer system preliminarily at the National Institute of Metrology (NIM). Several different time and frequency transfer experiments, including zero-baseline and long-baseline experiments with the same reference or the different references, conducted using GPS carrier phase with the GPS carrier-phase time and frequency transfer system by two different solution methods, were implemented and the experimental results are compared.
DTIC
Frequencies; Global Positioning System

20100018954 Los Alamos National Lab., NM USA
A Review - Gravel Gertie Full Scale Tests
Sharirli, Mohaen; Rose, Donald G; Aug 1998; 19 pp.; In English
Report No.(s): AD-A518541; LA-UR-98-2622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Gravel Gertie was designed as a space in which to perform what is generally conceded to be the most hazardous operation in the assembly of a nuclear explosive, the mating of the High Explosive (HE) and fissile material in the primary of the weapon. The target of the design was to have a space which, in case of an accidental explosion of the HE, would withstand the blast and gas pressure loads from the explosion, relieve the pressure produced by the explosion, and inhibit the release of particulate matter to the atmosphere. The history of the design of the Gravel Gertie is somewhat murky, but it seems to have been developed in 1956 by the Pantex Operating Contractor, Mason and Hanger-Silas Mason Co., Inc. It is not known who the smart guy was that named the facility for a character in the Dick Tracy cartoons but as you will see, the name is well taken. The heart of the Gravel Gertie is a round room with floors and wall sturdy enough to withstand the various loads that will be impressed on them and covered with a thick gravel roof suspended on a network of bridge cables. Staging areas are connected to the round room in all the Gravel Gerties constructed up to the present. Figure 1 is a plan of a DAF Gravel Gertie with its associated staging areas, service rooms and entrance airlocks.
DTIC
Explosives; Fissionable Materials; Full Scale Tests; Gravels; Nuclear Explosions

20100019046 Bureau International des Poids et Mesures, Sevres, France
Comparison of GPS and GLONASS Common-View Time Transfers
Lewandowski, W; Petit, G; Thomas, C; Cherenkov, G T; Koshelyaevsky, N B; Pushkin, S B; Dec 1992; 13 pp.; In English
Report No.(s): AD-A518815; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It has already been shown than even with a simple daily averaging of GLONASS data at each site, continental GLONASS time transfer can be achieved at a level of several tens of nanoseconds. A further step is to carry out observations of GLONASS satellites by the common-view method. This paper reports a comparison of GPS and GLONASS common-view time transfers between Russia and Western Europe. At each site, a GPS receiver and a GLONASS receiver are connected to the same atomic clock. Both GPS receivers are of NBS type and the GLONASS receivers are of type A-724. As GPS common-view time transfer between Sevres and Mendeleevo is accomplished at a level of a few nanoseconds in precision, it gives an excellent reference with which to evaluate the performance of GLONASS common-view time transfer.
DTIC
Atomic Clocks; Global Positioning System; GLONASS

20100019183 National Inst. of Standards and Technology, Boulder, CO USA

NIST-7, The U.S. Primary Frequency Standard: New Evaluation Techniques

Drullinger, R. E.; Shirley, J. H.; Lee, W. D.; Proceedings of the Annual Precise Time and Time Interval Applications and Planning Meeting (28th); Dec. 1996, pp. 255-264; In English; Annual Precise Time and Time Interval Applications and Planning Meeting (23rd), 3-5 Dec. 1996, Reston, VA, USA

Report No.(s): AD-A517882; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517882

Primary frequency standards achieve their accuracy by direct reference to the definition of the second and evaluation of all known sources of systematic terror that may perturb the measured resonance in the atom. NIST-7, the U.S. primary frequency standard, is a thermal, atomic-beam machine that uses optical pumping for atomic state preparation and detection, and digital frequency control. This technology enables the new evaluation techniques described here. All known systematic effects are determined by means of experiments not involving, or limited by, precision frequency measurements. This both speeds the evaluation and reduces the combined standard uncertainty. Its present value is 5-10(-13) for NIST-7.

DTIC

Frequencies; Frequency Standards

20100019196 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Application of the Three Short Calibration Technique in a Low Frequency Focus Beam System

Gunn Jr, William E; Mar, 2010; 86 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-JON-10-134

Report No.(s): AD-A518512; AFIT/GE/ENG/10-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electromagnetic material characterization is the process of determining the constitutive parameters of matter. In simple media, these parameters are permittivity and permeability. Characterization of these values is often accomplished through the use of waveguides, transmission lines, coaxial cables, and resonant cavities. Free space measurements systems are employed since they are non destructive (i.e., no sample machining is required) and broadband. Traditionally, time domain gating is utilized to mitigate systematic errors. However, an artifact of this calibration technique is band edge corruption due to data windowing. The goal of this research is to develop and apply a Three Short Calibration Technique to the General Electric Low Frequency (0.5-2GHz) Focus Beam System in order to preserve band edge data. It is shown that when working with low frequencies, such as the focus of this research, coupling effects due to multiple bounces within the collimating and focusing lenses as well as lens-sample interaction are not easily calibrated out. Although the coupling effects introduce extraneous clutter into the extracted constitutive parameter values, the results obtained agree with the known reference values of tested dielectric samples. It is concluded that with a more in depth study in sample/lens interaction at low frequencies, this calibration technique could prove useful in the accurate extraction of the desired low frequency constitutive parameter values.

DTIC

Calibrating; Electromagnetic Properties; Low Frequencies; Method of Characteristics

20100019199 National Inst. of Standards and Technology, Boulder, CO USA

Implementation of a Standard Format for GPS Common View Data

Weiss, Marc A; Thomas, Claudine; Proceedings of the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (26th); Dec. 1994, pp. 75-88; In English; Presented at the Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (26th) held in Reston, VA on 6-8 December 1994., 6-8 Dec. 1994, Reston, VA, USA

Report No.(s): AD-A518492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new format for standardizing common view time transfer data, recommended by the Consultative Committee for the Definition of the Second, is being implemented in receivers commonly used for contributing data for the generation of International Atomic Time. We discuss three aspects of this new format that potentially improve GPS common-view time transfer: (1) the standard specifies the method for treating short term data, (2) it presents data in consistent formats including needed terms not previously available, and (3) the standard includes a header of parameters important for the GPS common-view process. In coordination with the release of firmware conforming to this new format the Bureau international des Poids el Mesures will release future international track schedules consistent with the new standard.

DTIC

Atomic Clocks; Format; Global Positioning System

20100019269 Centre National d'Etudes Spatiales, Toulouse, France

EGNOS Network Time and Its Relationships to UTC and GPS Time

Delporte, Jerome; Suard, Norbert; Sidorov, Dmitry; Uhrich, Pierre; Nov 2009; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517931

EGNOS, the European Satellite Based Augmentation System, generates its own system time scale ENT (EGNOS Network Time). ENT is steered by the EGNOS Ground Control Segment to GPS time (GPST). The offset between ENT and UTC is broadcast in the EGNOS navigation message. To compute that offset, an EGNOS ground station was set up in the Observatoire de Paris and is connected to UTC (OP). Applying EGNOS corrections on GPS measurements provides a precise time and navigation solution referenced to ENT. Therefore, the assessment of the time difference between ENT and UTC is a key issue for time users. The aim of this paper is to assess the closeness of ENT to UTC and GPST. First, the paper recalls the timing aspects of EGNOS and describes the connection of ENT to UTC (OP). Then the broadcast time difference ENT - UTC (OP) is analyzed and compared to an independent method of computing that offset. This independent method makes use of the calibrated OPMT IGS station that is indirectly connected to UTC (OP). The agreement between the broadcast information and the independent method is discussed with respect to EGNOS requirements. Using the BIPM Circular T that provides UTC - UTC (OP), we can then easily derive the offset between ENT and UTC. This independent method can also be carried out using the IENG IGS station connected to UTC (IT), providing therefore ENT - UTC (IT). Moreover, an assessment of the time offset ENT - GPST is also carried out by two methods. The first method combines the broadcast offset ENT - UTC (OP) to the time differences UTC - UTC (OP) and UTC - GPST both extracted from BIPM Circular T. The second method combines the broadcast offset ENT - UTC (OP) to the REF - GPS obtained in the CGGTTS files coming from measurements made by the OPMT IGS receiver at the Observatoire de Paris referred to UTC (OP). Both results are compared and discussed.

DTIC

Global Positioning System; Time Response

20100019271 Bureau International des Poids et Mesures, Sevres, France

BIPM Time Activities Update

Harmegnies, A; Panfilo, G; Arias, E F; Nov 2009; 7 pp.; In English

Report No.(s): AD-A517922; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517922

This paper describes BIPM time activities related to the calculation of international reference time scales: UTC and TAI. Monthly, TAI and UTC are computed from clock data (representing 350 clocks coming from 69 institutes) and time transfer data used to compare clocks. Results are published each month in BIPM Circular T. Due to the evolution of time transfer techniques and clock types, the process of evaluation of TAI has to be regularly updated with newer and better techniques to improve the frequency stability and the frequency accuracy of TAI. Part of the improvements concerns clock comparisons: 1. introduction of new time transfer technique as GPS PPP and GLONASS Common View, 2. creation of new statistical tools in order remove outliers in TWSTFT time links, making the best use of time transfer results, 3. another improvement is a study on clock frequency prediction in ALGOS, which deals with H-maser clock properties, in order to well understand their impact on generated time scales. This publication reports on the work of the whole staff of the BIPM dedicated to time activities.

DTIC

Frequencies; Clocks; Frequency Stability

20100019385 Bureau International des Poids et Mesures, Sevres, France

Time Activities at the BIPM

Thomas, Claudine; Dec 1994; 19 pp.; In English

Report No.(s): AD-A518497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The generation and dissemination of International Atomic Time, TAI, and of Coordinated Universal Time, UTC, are explicitly mentioned in the list of the principal tasks of the BIPM, recalled in the Comptes Rendus of the 18th Conference Generale des Poids et Mesures, in 1987. These tasks are fulfilled by the BIPM Time Section thanks to international cooperation with national timing centers, which maintain, under metrological conditions, the clocks used to generate TAI. Besides the current work of data collection and processing, research activities are carried out in order to adapt the computation of TAI to the most recent improvements occurring in the time and frequency domains. Studies concerning the application of general

relativity and pulsar timing to time metrology are also actively pursued. This paper summarizes the work done in all these fields and outlines future projects.
DTIC
Atomic Clocks; Universal Time; Domains; Data Processing

20100019463 Office of the Under Secretary of Defense (Test Resource Management Center), Washington, DC USA
Joint Mission Environment Test Capability (JMETC)
Lockhart, Richard; Ferguson, Chip; International Test and Evaluation Association (ITEA) Journal; Jan. 2008; Volume 29, No. 2, pp. 160-166; In English
Report No.(s): AD-A517978; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517978

During the past six years, utilizing the concept of Joint Operations has become standard for successful U.S. military combat. The need for Joint interdependency and Joint systems interoperability during combat operations in Afghanistan and Iraq is irrefutable. Consequently, Joint lessons learned are rapidly being incorporated in combat operations and Service/Joint training programs. However, Joint lessons have proven to be elusive and slow to take hold in the Department of Defense (DoD) acquisition and testing communities. Despite the popularity of the common catch phrase Born Joint, many systems are fielded without a rigorous and credible test of their capabilities in a Joint operating environment. Performance of Joint systems must be evaluated in a Joint environment, and the only way to do that effectively, efficiently, and early in acquisition is to link distributed high-fidelity test facilities creating a realistic Joint environment. However, the proliferation of unique, noninteroperable, and expensive testing infrastructures remains widespread within the DoD. To effectively and efficiently test systems in a Joint environment, the DoD needed an enterprise-level LVC distributed test capability using a common infrastructure. The Joint Mission Environment Test Capability (JMETC) program was initiated in FY 07 to meet that need. This article provides a brief description of the JMETC program and the capabilities it is providing, as well as its recent accomplishments.
DTIC
Defense Program; Environmental Tests; Evaluation; Interoperability; Performance Tests; System Effectiveness

20100019548 Allan's Time, Fountain Green, UT USA
Tutorial: Clock and Clock Systems Performance Measures
Allan, David W; Dec 1995; 27 pp.; In English
Report No.(s): AD-A518410; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This tutorial contains basic material - familiar to many. This will be used as a foundation upon which we will build - bringing forth some new material and equations that have been developed especially for this tutorial. These will provide increased understanding toward parameter estimation of clock and clock system's performance. There is a very important ITU Handbook being prepared at this time which goes much further than this tutorial has time to do. I highly recommend it as an excellent resource document. The final draft is just now being completed, and it should be ready late in 1996. It is an outstanding handbook; Dr. Sydnor proposed it to the ITU-R several years ago, and is the editor with my assistance. We have some of the best contributors in the community from around the world who have written the ten chapters in this handbook. The title of the Handbook is, Selection and use of Precise Frequency and Time Systems. It will be available from the ITU secretariat in Geneva, Switzerland, but NAVTEC Seminars also plans to be a distributor.
DTIC
Clocks; Precision; Frequencies

20100019550 Office of the Director of Defense Research and Engineering, Washington, DC USA
Strategic Imperatives for the DoD Science and Technology Program
Shaffer, Al; Apr 2009; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518307; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) Defense Research and Engineering (DDR&E) vision is to develop the technology needed to defeat any adversary, state and non-state, on any battlefield, including space and cyberspace. Technology opportunities are expanding, but not well understood. The pace of technological change is ever increasing. DoD technological focus is shifting away from an emphasis on ships, tanks, and planes - to focus on protection, information, knowledge, and

timely, actionable intelligence in an every changing world. National defense strategy drives the DoD investment strategy.
DTIC
Research and Development; Military Technology

20100019655 Maine Univ., Orono, ME USA
The Source, Cycling, and Behavior of Chromophoric Dissolved Organic Matter in Coastal Waters
Wells, Mark L; Boehme, Jennifer; Jan 2008; 14 pp.; In English
Contract(s)/Grant(s): N00014-05-1-0116
Report No.(s): AD-A518868; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518868

Our long term research goal is to ascertain the nature and magnitude of optical effects (absorbance / fluorescence / scattering) in surface seawaters associated with the production and cycling of marine colloidal organic matter. We are particularly interested in determining how these effects are driven or modulated by the productivity dynamics of phytoplankton and marine heterotrophic bacteria in coastal regions not directly influenced by high riverine inputs of terrestrially-derived materials.
DTIC
Chromophores; Coastal Water; Coasts; Cycles; Dissolved Organic Matter; Dissolving; Fluorescence; Marine Environments; Organic Materials

20100019657 Scripps Institution of Oceanography, La Jolla, CA USA
The Influence of Breaking at the Ocean Surface on Oceanic Radiance and Imaging
Melville, W K; Jan 2008; 12 pp.; In English
Contract(s)/Grant(s): N00014-06-1-0048
Report No.(s): AD-A518870; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518870

The long-term goals of the work are to measure the influence of surface wave breaking on imaging across the surface and develop measurements and models of breaking statistics as input to the interpretation and modeling of oceanic radiance measurements. Image transmission across breaking surfaces will be measured in both the laboratory and the field. Field measurements of breaking and breaking statistics will be used to quantify the degradation and recovery of image fidelity by surface and subsurface processes associated with breaking, including surface turbulence and bubble entrainment. The PI will collaborate with other PIs in the use of breaking measurements and models to interpret measurements and develop models of oceanic radiance and through-surface imaging.
DTIC
Image Processing; Imaging Techniques; Ocean Surface; Radiance; Surface Waves

20100019658 Maine Univ., Walpole, ME USA
Temporal and Spatial Scales of Terrestrially-derived Particulate and Dissolved Materials in the Penobscot River System: Quantifying Conserved and Nonconserved Optical Properties and Transformations within the Estuary
Roesler, Collin S; Barnard, Andrew H; Jan 2008; 11 pp.; In English
Contract(s)/Grant(s): N00014-08-1-0032
Report No.(s): AD-A518871; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518871

Coastal waters represent the commingling of offshore marine and terrestrial surface source waters and therefore are naturally complex and variable. Our long term goal is to establish observational and modeling approaches to predict sources and scales of variability in the source waters, particularly those related to land use activities in upstream watersheds, from observations and measurements in the coastal waters. Hydrologic optics provides an approach to characterizing physical and biogeochemical processes in aquatic systems over a range of time and space scales. The linkage between observations of the inherent optical properties (IOPs; absorption, scattering and fluorescence) and the geophysical properties lie in the establishment of robust optical proxies and the quantification of the temporal and spatial scales over which these proxies remain conservative in their properties. Our objectives are to identify and quantify specific optical and chemical characteristics of the colored particulate and dissolved fractions originating in the Penobscot River system that are associated with defined land use activities (land use proxies), and to determine the scales of variability over which these proxies can be detected both

temporally (i.e. seasonal and episodic events) and spatially (from the source into coastal waters).
DTIC
Biogeochemistry; Coasts; Color; Dissolved Organic Matter; Estuaries; Fluorescence; Optical Properties; Particulates; Rivers

20100019670 Army Engineer Research and Development Center, Vicksburg, MS USA
Establishment of the TREECS Platform: A Survey of Existing Tools, Portals, and Frameworks
Gerald, Jeffrey A; Dortch, Mark S; Johnson, Billy E; Fontan, Michael R; Dec 2009; 29 pp.; In English
Report No.(s): AD-A518931; ERDC-TN-EQT-09-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518931

The Training Range Environmental Evaluation and Characterization System (TREECS) is being developed by the Environmental Laboratory of the U.S. Army Engineer Research and Development Center (ERDC) to provide a tool with varying levels of capability to forecast the fate of munitions constituents (MC) within and transported from ranges and provide the range manager with strategies to meet environmental compliance goals for human and ecological health. TREECS will be developed mainly as a web-enabled system although the more advanced analysis tiers may require the user to download analysis components that will need to be run on his/her system. TREECS initially focuses on contaminant stressors and health-based end points, but allows the addition of other stressors and environmental end-point metrics. The general approach to developing TREECS is analysis of existing tools for use in training range environmental risk evaluation and the development of innovative adaptations of those tools that are appropriate and can easily be applied to manage ranges. This technical note describes the existing tools, portals, and frameworks that are undergoing evaluation for use with TREECS and whether the underlying technology/data of those and TREECS should support linkages to one another.
DTIC
Computer Programs; Ecology; Environment Management; Surveys

20100019683 Army Research Lab., Aberdeen Proving Ground, MD USA
Gap Formations in Simulations of SHPB Tests on Elastic Materials Soft in Shear
Raftenberg, M N; Scheidler, M J; Sep 2009; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-622618H80
Report No.(s): AD-A518966; ARL-RP-272; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518966

The LS-DYNA code was applied to split Hopkinson pressure bar tests on a material at least two orders of magnitude stiffer in dilatation than in shear. Two constitutive models were applied, linear elasticity and a compressible form of Mooney- Rivlin elasticity. The latter was fitted to data from ballistic gelatin. The incident and transmission bars were aluminum. The nominal strain rate was 2500/s. Gaps appeared at the interfaces between the specimen and both bars. Unloading of the specimen and bars accompanied these gaps. The input-velocity rise time was varied to observe pulse shaping effects. Mesh sensitivity and contact-parameter sensitivity studies were performed.
DTIC
Elastic Properties; Gelatins; Simulation

20100019712 Miami Univ., Oxford, OH USA
High Precision GPS Measurements
Morton, Y; van Graas, F; Feb 28, 2010; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-07-1-0354
Report No.(s): AD-A519017; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519017

The objective of this project is to develop high precision GPS receivers by utilizing modernized GPS signals at L1, L2, and L5 frequencies to mitigate GPS measurement errors. For each successfully acquired and tracked GPS signal, a GPS receiver generates two receiver-satellite range observables: the code phase and the carrier phase measurements. Precision GPS solutions are obtained by exploiting both observables at all available frequencies to eliminate, reduce, or estimate various error sources. These error sources include signal propagation errors through the ionosphere and troposphere, satellite orbit and clock errors, receiver clock error, receiver noise, multipath error, hardware bias, and integer cycle ambiguities associated with the carrier phase observables. The project proposed an array of innovative methods to assess and mitigate these errors. Since the start of the project in March 2007, we made significant progress in three major areas: (a) Higher order ionosphere error

temporal and spatial variations studies; (b) satellite orbit and clock error characterization; (c) modeling of troposphere error under severe weather conditions. The report summarizes the progress made in these three areas.
DTIC
Global Positioning System; Measurement; Navigation Satellites; Precision; Radio Receivers

20100019733 Naval Undersea Warfare Center, Newport, RI USA
Passive Acoustic Measurement of Dive Vocal Behavior and Group Size of Blainville's Beaked Whale (Mesoplodon densirostris) in the Tongue of the Ocean (TOTO)
DiMarzio, Nancy; Moretti, David; Ward, Jessica; Morrissey, Ronald; Jarvis, Susan; Izzi, Anna M; Johnson, Mark; Tyack, Peter; Hansen, Amanda; Jan 2008; 9 pp.; In English
Report No.(s): AD-A519080; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519080

The vocal behavior of Blainville's beaked whale (Mesoplodon densirostris) was measured using the bottom-mounted hydrophones of the Atlantic Undersea Test and Evaluation Center (AUTEC) in the Bahamas. The statistics for the vocal durations and gaps within these vocal periods were measured over multiple deep foraging dives. The sizes of foraging groups of M. densirostris were estimated from the dive vocalization durations by applying click rate and detection ratio statistics derived from Woods Hole Oceanographic Institution (WHOI) Digital recording Tags (DTags) to visually verified data collected on the AUTEC range.
DTIC
Acoustic Measurement; Animals; Bahamas; Oceans; Tongue; Underwater Acoustics; Whales

20100019739 Massachusetts Univ., Amherst, MA USA
Equipment in Support for Polarimetric Imaging
Schultz, Howard; Jan 2008; 9 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0731
Report No.(s): AD-A519103; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519103

The wind-driven sea surface is characterized by wind waves with a wide range of spatial and temporal scales. Small waves, with millimeter to centimeter wavelengths, ride on the longer waves and play a crucial role in fundamental interfacial geophysical processes. These include wind stress, air-sea gas exchange, and optical transmission through the surface, microwave backscatter, amongst others. As well, this small-scale roughness underpins many marine remote sensing technologies, such as scatterometry, altimetry and synthetic aperture radar. These satellite sensors are the primary data sources of winds and waves over the planet's oceans. However, current knowledge of the sea surface roughness is incomplete, especially at these shorter scales, which degrades the accuracy of the satellite data products. To improve both sensor and modeling accuracy for a wide range of air-sea interfacial processes, a more detailed description of the small-scale roughness is needed. As these scales have small amplitudes, but finite steepness, measuring their slope properties is intrinsically well-suited to their characterization.
DTIC
Backscattering; Detection; Detectors; Image Processing; Imaging Techniques; Ocean Surface; Polarimetry; Scatterometers; Shear Stress; Slopes; Wind Shear

20100019763 Institute of Ocean Sciences, Sidney, British Columbia Canada
Acoustic Measurements of Tiny Optically Active Bubbles in the Upper Ocean
Vagle, Svein; Jan 2008; 6 pp.; In English
Contract(s)/Grant(s): N00014-06-1-0379
Report No.(s): AD-A519174; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519174

In this project, which is closely linked to a separate project where the goal is to measure wave induced bubble clouds and their effect on radiance in the upper ocean (N000140710754), we intend to address the disturbing fact that despite the fundamental importance of optical backscatter in the ocean it is still not possible to explain more than 5 to 10 percent of the particulate backscattering in the ocean based on known constituents even during periods with no active wave breaking (Terrill & Lewis, 2004). One hypothesis is that very small bubbles that have been stabilized by surfactants may be responsible for part

of the missing backscatter. The long-term goal of this project is to detect these small bubbles and to determine their concentration using acoustic techniques.
DTIC
Acoustic Measurement; Bubbles; Marine Environments; Oceans; Particulates; Scattering

20100019777 Quartz Research and Production Association, Russian Federation
Design and Industrial Production of Frequency Standards in the USSR
Demidov, N A; Uljanov, A A; Dec 1990; 23 pp.; In English
Report No.(s): AD-A519213; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519213

Some aspects of research development and production of quantum frequency standards, carried out in QUARTZ Research and Production Association (RPA), Gorky, USSR, have been investigated for the last 25-30 years. During this period a number of rubidium and hydrogen frequency standards, based on the active maser, have been developed and put into production. The first industrial model of a passive hydrogen maser has been designed in the last years. Besides frequency standards for a wide application range, RPA QUARTZ investigates metrological frequency standards - cesium standards with cavity length 1.9 m and hydrogen masers with a flexible storage bulb.
DTIC
Frequency Standards; U.S.S.R.

20100019884 Science Applications International Corp., McLean, VA USA
Hydroacoustic Propagation and Reflection Loss Using Explosions Found in the Indian Ocean
Hanson, Jeffrey A; Reasoner, Colin L; Bowman, J R; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-C-0138
Report No.(s): AD-A519370; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We investigate propagation and reflection loss using hydroacoustic waves from explosion sources in the Indian Ocean recorded at the International Monitoring System's (IMS) hydrophone stations. We developed a discovery procedure that searches the automatic processing results from the International Data Centre (IDC) for signals that match explosive characteristics. Potential candidate explosions are confirmed by examination of the raw waveform data. Using this procedure, we have identified hundreds of explosions throughout the Indian Ocean Basin. The instigators of the explosions are not known, but the locations and characteristics of the explosions lend themselves to likely candidates. These include military exercises, construction, geophysical exploration, and local fishing practices. We examined hydroacoustic data covering a 6-year period and identified 305 separate explosions. Of these, 25 were recorded at three hydrophone triads - Cape Leeuwin, Australia (H01W), Crozet Island (H04N) and Diego Garcia (H08S) - 79 were recorded at two triads - H04N and H08S - and 201 were recorded at a single triad. In addition, we have observed many airgun surveys, but they are not of interest here due to their local nature. We are able to locate explosions observed at three or two triads using direct arrivals. In some cases, we can locate explosions recorded at a single triad using observed reflections. Absolute arrival times can be estimated to less than 2 seconds, and relative times for closely spaced explosions can often be estimated to within a few samples (4 to 12 milliseconds). Backazimuth uncertainty estimates range from a few tenths of a degree to several degrees depending on the frequency content of the signal and noise conditions at the triad. The explosions are distributed in three general locations: the Arabian Sea off northwestern India, the Bay of Bengal, and along the islands of western Indonesia.
DTIC
Explosions; Hydrophones; Indian Ocean; Losses; Nuclear Explosions; Signal Processing; Sound Fixing and Ranging; Underwater Acoustics

20100019907 Leeds Univ., UK
Current GPS/GLONASS Time References and UTC
Daly, P; Dec 1990; 10 pp.; In English
Report No.(s): AD-A519433; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The world's two global satellite navigation systems, GPS and GLONASS, will both become operational during the early 1900's. Each will offer, independently of the other, precise location and time transfer continuously anywhere in the world and indeed in space itself. Many potential users, in particular the civil aviation community, are keenly interested in a joint GPS/GLONASS operation since it would offer substantial advantages in defining and maintaining the integrity of the navigation aid. The question arises of compatibility of GPS/GLONASS from the point of view of satellite on-board clocks,

their system references, their national standards and ultimately UTC. Results are presented on the characterisation of GLONASS system and spacecraft clocks as compared to their Navstar GPS counterparts.
DTIC
Global Positioning System; GLONASS

20100019950 Naval Academy, Annapolis, MD USA
Improving Store Separation Six-Degree-of-Freedom Tools (ISSSDF)
Hallberg, Eric; Jan 2007; 4 pp.; In English
Report No.(s): AD-A519519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force uses the TGP program as its primary tool for predicting store trajectories on the basis of wind tunnel grid data. The US Navy uses NAVSEP, which is based on an earlier version of the TGP code. Both codes are based on the AEDC Multi-Dimensional Interpolation Trajectory Generation Program, and have undergone numerous improvement/modifications during the past 15 years. The U.S. Navy and Air Force have also recently acquired Store Trajectory Estimation in a MATLAB Environment (STEME) code from the Australian Air Force. NAVAIR is in the process of preparing a flight clearance for the High Speed Antiradiation Demonstrator (HSAD) program. This clearance will be prepared using the conventional tool NAVSEP. The HSAD missile, however, utilizes an autopilot to move four movable control fins shortly after release as it rapidly accelerates in flight speed. It would be highly desirable to fully account for these elements in the release simulation using either NAVSEP, TGP, or STEME. NAVSEP, TGP have amassed a long lineage of wind tunnel data, flight simulation predictions, and flight test data with which to perform code validation and verification. Therefore, new developments should preserve as much backward compatibility as possible with existing TGP codes while improving and developing user interfaces and increasing functionality. In conjunction with the conventional NAVSEP approach to clear the HSAD missile, it would be desirable to test the TGP and STEME codes for the same case. It would be desirable to develop the general methodology to integrate the current 6 DOF analysis approaches with the proposed MATLAB/Simulink auto-pilot environment. The Navy is currently involved in developing the joint-service Joint Common Missile with Lockheed. Both FLIP TGP and NAVSEP codes coupled with MATLAB/Simulink will be tested for this particular missile. Recently, a Beggar approach with hard-coded autopilot has been practiced.
DTIC
Degrees of Freedom; Flight Tests; Trajectories

20100019960 Texas Univ. at Dallas, Richardson, TX USA
Interdisciplinary Studies on the Combat Readiness and Health Issues Faced by Military Personnel
Hart, Jr, John; Sep 1, 2009; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-1-0492
Report No.(s): AD-A519542; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research project was twofold. Task number 1: Assemble a multimodal human performance laboratory that includes a complex human motor assessment system, 128 channel electroencephalogram/event-related potential system, a pupilometer/eye-tracking system, and a repetitive transcranial magnetic stimulation system. Task number 2: Conduct a pilot research study demonstrating the capabilities of performing multimodal assessment of object retrieval, particularly when those objects may be considered threatening or nonthreatening. Task 1 has been completed and was reported on previously. The pilot study (Task 2) has not yet been completed.
DTIC
Cognition; Combat; Electroencephalography; Eye Movements; Health; Human Performance; Laboratories; Military Personnel; Psychomotor Performance

20100019969 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Portable Rapid Test Fuel Tank Leak Detection System
Major, William; Karr, Leslie; Apr 2010; 86 pp.; In English
Report No.(s): AD-A519556; NFESC-TM-2412-ENV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Portable Rapid Test (PRT) tank leak detection system development was conducted under the Chief of Navy's 0817 Pollution Abatement Ashore RDT&E program. Its goal was to bring Navy fuel tanks into regulatory compliance in a cost-effective manner. The PRT Leak Detection System was successfully designed and evaluated for use in 50,000 gallon fuel underground storage tanks (USTs). Using EPA mandated procedures, the PRT achieved a 0.067 gal/hr leak rate with 95% probability of detection (PD) and 5% probability of false alarm (PFA) during 3rd Party Certification Testing at the Barking

Sands Pacific Missile Range fuel farm, Kauai, Hawaii. This is the best EPA approved leak rate achieved to date in industry worldwide for a 50,000 gallon in-tank system, with results in 5-hours, and is the only available system which has the dual capability for conducting a combined monthly and annual compliance test. The system allows testing at EPA standard leak rates of 0.10 gal/hr and 0.20 gal/hr with a very high PD and very low PFA. This provides a significant improvement over current methods technologically, operationally, and in short and long-term cost benefits. The final report steps through the development stages of the PRT technology including off-the-shelf component elections, development of new hardware and software, system integration, and laboratory, field and certification testing.
DTIC
Detection; Fuel Tanks; Leakage

20100020035 Ministry of Posts and Telecommunications, Japan
Millisecond Pulsar Observation System at CRL
Hanado, Y; Kiuchi, H; Hama, S; Kaneko, A; Imae, M; Dec 1991; 8 pp.; In English
Report No.(s): AD-A519743; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Millisecond pulsars attract attentions as a future reference clock in place of present atomic clocks by reason of their highly stable pulse timing. CRL (Communications Researchh Laboratory) has been developing an observation system to measure the pulse timing of millisecond pulsar precisely, and recently has completed its basic part. By using it, we observed PSR1937 + 21 at 1.5GHz band and got a pulse timing with a precision of 1 Beta(usec)/gamma by 5 days observation.
DTIC
Atomic Clocks; Observation; Pulsars

20100020039 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Imperatives for T&E Change Must Come from Within
Simmons, Brian M; Jul 2006; 4 pp.; In English
Report No.(s): AD-A519789; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The demands for change in test and evaluation (T&E) occurring right now are significant. And, the future for T&E will emerge to be quite different than previously predicted. Why? Consider these significant examples: (1) the systems acquisition and associated T&E process has changed during wartime and is unlikely to return to the traditional process when the war is over; (2) business transformation demands more efficiency in T&E processes now; and (3) networked testing requires the testers to rely on each other as opposed to staying in traditional Service, local test range, or developmental test (DT)/operational test (OT) domains. How, then, do we execute our primary mission as the urgency to rapidly field solutions for the war in Iraq and Afghanistan continues to grow? T&E information has, for decades, provided the necessary information that milestone decision authorities need to determine which weapons systems get fielded when, and to whom. This is still true, but in the Army the traditional customer base (the Program Managers [PMs]/Program Executive Offices [PEOs]) is shifting to include direct requests from users in the theater of war. To respond to these theater requests, the Army Test and Evaluation Command (ATEC) has established a Forward Operational Assessment (FOA) team in Iraq comprising military operational testers and civilian developmental testers. Now on its fifth rotation, the subject matter expertise resident in this team is able to directly relay materiel needs from the fight to the test ranges. Further, this team has the ability to conduct limited testing in theater, which is augmented by more extensive stateside T&E. In the Army, the newest efficiency and quality program is Lean 6 Sigma. It is a mandatory endeavor for every Army major command. Full cost visibility and employment of business approaches to T&E have been recurring themes from Congress and OSD for years. The demand to identify and reduce costs is here to stay.
DTIC
Evaluation; Interoperability; Networks; System Effectiveness; Weapon Systems

20100020279 Air Force Research Lab., Wright-Patterson AFB, OH USA
Comparing Manual and Cooperative Control Mission Management Methods for Wide Area Search Munitions
Warfield, Lamar; Carretta, Thomas R.; Patzek, Michael J.; Estepp, Justin R.; O'Neal, John K.; November 2009; 48 pp.; In English
Contract(s)/Grant(s): Proj-7184; 62202F
Report No.(s): AD-A519651; AFRL-RH-WP-TR-2010-0063; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wide Area Search Munitions (WASMs) combine the attributes of unmanned aerial vehicles with those of traditional

munitions. The WASM concept envisions artificially intelligent munitions that communicate and coordinate with one another and with human operators to effectively to perform their tasks. This study examined target acquisition for unaided operators with that of an automated cooperative controller for a complex task involving the prosecution of ground-based targets. Participants completed nine trials for each control mode (manual and cooperative) by number of WASMs (4, 8, or 16) combination. Target hit rate was not affected by control mode or number of WASMs; however, target acquisition efficiency degraded under manual control and as the number of WASMs increased. Workload was greater for the manual mode and increased as the number of WASMs increased. Self-ratings of the ability to perform a simultaneous attack were lower for the manual mode and decreased as the number of WASMs increased.
DTIC
Ammunition; Control; Management Methods; Manual Control; Neural Nets; Ordnance; Scanners; Scanning; Target Acquisition

20100020281 Sitek Research Labs., Rockville, MD USA
In Vivo Test for Chemical Induction of Micronucleated Polychromatic Erythrocytes in Mouse Bone Marrow Cells. Test Article: Dimethylamine-2-2ethyl azide (DMAZ)
Song, Jian; Shore, Karen S.; June 25, 2008; 69 pp.; In English
Contract(s)/Grant(s): W91ZLK-07-P-1646
Report No.(s): AD-A519529; SITEK-0976-1521; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Dimethylamine-2-2ethyl azide (DMAZ, 99.3% pure) was tested for its potentials to induce micronucleated polychromatic erythrocytes (MPCE) in the bone marrow cells of male and female CD-1 mice according to OECD TG 474 in compliance with Good Laboratory Practice. Male and female mice were dosed orally at 125, 250, and 500 mg/kg. Animals were euthanized approximately 24 and 48 hrs after dosing. The percentage of polychromatic erythrocytes (PCE) and the frequency of micronucleated polychromatic erythrocyte (MPCE) were determined at 24 and 48 hrs. Cytotoxicity was assessed by scoring the number of PCE and norchromatic erythrocyte (NCE) in first 200 erythrocytes for each animal. There were no statistically significant increases in the number of MPCE in the treated groups when compared to the concurrent vehicle control group. These results indicate that DMAZ did not cause chromosome damage in the in vivo mouse micronucleus assay and therefore it is not considered to be a clastogenic agent.
DTIC
Amines; Azides (Inorganic); Azides (Organic); Bone Marrow; Cells (Biology); Erythrocytes; In Vivo Methods and Tests; Methyl Compounds; Mice

20100020291 National Nuclear Security Administration, Washington, DC USA
Next-Generation MDAC Discrimination Procedure Using Multi-Dimensional Spectral Analyses
Fisk, Mark D.; Taylor, Steven R.; Patton, Howard J.; Walter, William R.; September 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AC52-07NA28116
Report No.(s): AD-A519673; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Theoretical understanding of regional P/S discriminants and their frequency dependence has been an important, long-standing research topic. Following Xie and Patton (1999), Fisk et al. (2005) and Fisk (2006) used modified Brune (1970) and Mueller and Murphy (1971) [MM71] models to explain the frequency dependence of Pn/Lg and Pn/Sn discrimination performance for earthquakes and underground nuclear explosions (UNEs) near the Lop Nor, Semipalatinsk, and Novaya Zemlya test sites as mainly due to differences in explosion P and S corner frequencies. Fisk (2007) used source model fits to estimate Pn, Pg, and Lg corner frequencies for Nevada Test Site (NTS) explosions and found that Lg corner frequencies exhibit similar scaling with source size as for Pn and Pg, but shifted lower, analogous to observations by Fisk (2006) for other test sites. A key result is that increasing separation of regional P/S at higher frequencies between earthquakes and explosions at all of these test sites has a consistent model-based explanation mainly in terms of the difference between explosion P and S corner frequencies. Discrimination begins to improve at the explosion S-wave corner frequency and saturates at the explosion P-wave corner frequency, in agreement with empirical experience obtained over decades. We describe how grids of P/S spectral ratios for all combinations of frequencies for P and S wave spectra, which exhibit far greater differences in relative spectral amplitudes and shapes between explosions and earthquakes than considered before, and source models can be used to significantly enhance discrimination performance and confirm the physical basis of the results.
DTIC
Earthquakes; Nuclear Explosions; Spectrum Analysis; Surface Waves; Underground Explosions

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COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20100018476 Government Accountability Office, Washington, DC, USA

Media Programming: Factors Influencing the Availability of Independent Programming in Television and Programming Decisions in Radio

March 2010; 51 pp.; In English

Report No.(s): PB2010-105948; GAO-10-369; No Copyright; Avail.: CASI: A04, Hardcopy

The media industry plays a vital role in informing and entertaining the public. Media ownership and the availability of diverse programming have been a long-standing concern of Congress. Despite numerous programming choices in television and radio available to the public, some studies have reported that independently produced programming--that is, programming not affiliated with broadcast networks or cable operators--has decreased through the years. This requested report discusses (1) the extent to which the sources of television programming have changed over the last decade, (2) the factors industry stakeholders identified as affecting the availability of independent television programming, and (3) the factors industry stakeholders identified as influencing programming decisions in radio. To address these issues, GAO analyzed data from the Federal Communications Commission (FCC) and industry on sources of broadcast television programming in prime time (weeknights generally from 8:00 p.m. to 11:00 p.m.) and companies owning cable networks, as well as radio format data to determine programming variety. GAO also reviewed legal, agency, and industry documents and interviewed industry stakeholders, public interest groups, and others. GAO provided FCC with a draft of this report for comment. In response, FCC provided technical comments that we incorporated where appropriate.

NTIS

Broadcasting; Television Systems; Data Transmission

20100018486 Royal Inst. of Tech., Stockholm, Sweden

Stability and Systems Under Interference Feedback

Moller, Anders; Jonsson, Ulf T.; January 2009; 10 pp.; In English

Report No.(s): PB2010-106027; TRITA-MAT-08-OS-10; Copyright; Avail.: National Technical Information Service (NTIS)

Distributed power control problems in wireless communication can be modeled as a highly nonlinear feedback system. The nonlinear coupling appear when a large number of mobile stations interact through interference and it is well known that this may lead to instabilities. In this paper a number of results on existence and uniqueness of solution and boundedness and convergence of the solution are derived for systems with higher order control loops.

NTIS

Feedback; Stability

20100018655 Marine Corps Development and Education Command, Quantico, VA USA

Communication Technology: The New Mercenary

Ralston, Adam R; Feb 20, 2009; 14 pp.; In English

Report No.(s): AD-A517795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517795

The Marine Corps no longer fights conventional battles. Today's enemies are not necessarily gun-toting combatants; they can be abstracts like hunger, poverty, and a lack of reliable information. When fighting both conventional and unconventional enemies at the same time, the challenge to stay informed with up-to-date intelligence at the lowest echelons of decentralized command can pose as big a problem as the insurgency itself. Fortunately, commercial technology is advancing at unprecedented rates, providing an ever-widening array of communication tools to keep the operational forced informed up and down the chain of command. Unfortunately, this commercial equipment comes at a cost: complex maintenance requirements or lack of experienced operators will mitigate the equipment's usefulness. In the end, the Marine Corps' overdependence on commercial, off-the-shelf (COTS) communication equipment is weakening the Corps' ability to self-sustain by creating a reliance on warrantees and distant repair centers for maintenance and replacement, civilian contractors for technical support, and on-the-job training as the sole source of operator instruction.

DTIC

Communication Equipment; Maintenance

20100018688 Purdue Univ., West Lafayette, IN USA

On Maximizing the Lifetime of Delay-Sensitive Wireless Sensor Networks with Anycast

Kim, Joohwan; Lin, Xiaojun; Shroff, Ness B; Sinha, Prasun; Jan 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-10376; CNS-0626703

Report No.(s): AD-A517880; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517880

Sleep-wake scheduling is an effective mechanism to prolong the lifetime of energy-constrained wireless sensor networks. However, it incurs an additional delay for packet delivery when each node needs to wait for its next-hop relay node to wake up, which could be unacceptable for delay-sensitive applications. Prior work in the literature has proposed to reduce this delay using anycast, where each node opportunistically selects the first neighboring node that wakes up among multiple candidate nodes. In this paper, we study the joint control problem of how to optimally control the sleep-wake schedule, the anycast candidate set of next-hop neighbors, and anycast priorities, to maximize the network lifetime subject to a constraint on the expected end-to-end delay. We provide an efficient solution to this joint control problem. Our numerical results indicate that the proposed solution can substantially outperform prior heuristic solutions in the literature, especially under the practical scenarios where there are obstructions in the coverage area of the wireless sensor network.

DTIC

Communication Networks; Sensitivity

20100018689 Purdue Univ., West Lafayette, IN USA

On the Construction of a Maximum-Lifetime Data Gathering Tree in Sensor Networks: NP-Completeness and Approximation Algorithm

Wu, Yan; Fahmy, Sonia; Shroff, Ness B; Jan 2008; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-10376; 0238294

Report No.(s): AD-A517885; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517885

Energy efficiency is critical for wireless sensor networks. The data gathering process must be carefully designed to conserve energy and extend the network lifetime. For applications where each sensor continuously monitors the environment and periodically reports to a base station, a tree-based topology is often used to collect data from sensor nodes. In this work, we study the construction of a data gathering tree to maximize the network lifetime, which is defined as the time until the first node depletes its energy. The problem is shown to be NP-complete. We design an algorithm which starts from an arbitrary tree and iteratively reduces the load on bottleneck nodes (nodes likely to soon deplete their energy due to high degree or low remaining energy). We show that the algorithm terminates in polynomial time and is provably near optimal.

DTIC

Algorithms; Approximation; Communication Networks; Construction

20100018721 National Defense Univ., Washington, DC USA

Joint Functional Command for Intelligence, Surveillance, and Reconnaissance

Denton, James L; Jan 2007; 4 pp.; In English

Report No.(s): AD-A517973; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517973

Intelligence, surveillance, and reconnaissance (ISR) operations continue to perform a vital role in the war on terror and promise to remain integral to current and future wars. That our military can execute the ISR mission has never been in question; the challenge is the efficiency, flexibility, and agility of that execution. The U.S. Strategic Command (USSTRATCOM) Joint Functional Component Command for Intelligence, Surveillance, and Reconnaissance (JFCC-ISR) is engaged in that challenge. On January 10, 2003, President George W. Bush endorsed the reality that ISR touches every mission area from combating weapons of mass destruction to integrated missile defense to small unit operations. On that date, he signed Unified Command Plan 02, Change 2, which gave USSTRATCOM the responsibility for Department of Defense (DoD) ISR. This responsibility has transferred without change in subsequent plans, making the commander of USSTRATCOM responsible for the execution of the global ISR mission, which he chose to do through the creation of the JFCC-ISR. To meet those responsibilities, JFCC-ISR develops strategies and plans; integrates DoD, national, and international partner capabilities; and executes DoD ISR operations to satisfy combatant command and national operational and intelligence requirements. A great benefit of the DIA location is the across the hall proximity to the Defense Joint Intelligence Operations Center (DJIOC). The two organizations are in the process of integrating their operations centers. The JFCC-ISR launched two ambitious initiatives to redefine ISR allocation and management. The first is a new ISR Global Force Management model that uses a

mission-based approach to allocating ISR assets as opposed to a calendar-based one. The second effort is the ISR transition Team. On January 1, 2007, the Team launched an initiative to develop well-understood, practical, and executable best practices for operationally phased ISR support to the combatant commands.
DTIC
Command and Control; Intelligence; Military Operations; Reconnaissance; Surveillance

20100018740 Naval Research Lab., Washington, DC USA
Underwater Acoustic Communications for Bottom Mounted Sensor Networks
Gendron, P J; Jan 2008; 4 pp.; In English
Report No.(s): AD-A518013; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518013

The U.S. Navy's SEA POWER 21 FORCEnet vision demands the development of undersea sensing systems that can provide the warfighter with accurate and rapid awareness of the battlespace environment. To this end, undersea sensor networks in shallow water environments will be required to act as defensive fields and barriers in the protection of American shores, Navy assets, and sea bases.1 The Deployable Autonomous Distributed System (DADS) is such a network, tailored for the purpose of antisubmarine warfare (ASW). Equipped with acoustic and electromagnetic sensors coupled to robust data fusion schemes, DADS automates the reduction of sensor data to useful information, thereby greatly assisting decision-making personnel to ensure that enemy submersibles are kept at a distance from friendly forces.2
DTIC
Acoustics; Communication; Sound Transmission; Underwater Acoustics; Underwater Communication

20100018798 Army War Coll., Carlisle Barracks, PA USA
Faust and the Padshah Sphinx: Reshaping the NATO Alliance to Win in Afghanistan
Mastriano, Douglas V; Feb 24, 2010; 31 pp.; In English
Report No.(s): AD-A518150; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518150

Afghanistan is the greatest challenge that we face in the post-Cold War period. The NATO-led International Security Assistance Force (ISAF) in Afghanistan faces challenges that inhibit its ability to accomplish the mission. Amongst the challenges NATO faces are a lack of unity of effort, divergent political wills, and divergent U.S. and European reactions to the complex Afghan strategic environment. To remedy this situation, NATO, and its most influential member, the USA, must undertake a concerted effort to provide realistic solutions to these challenges. Among the remedies suggested in this paper are establishing unity of effort and unity of command through competent strategic leadership, employing forces where they appropriately suit the mission, and developing a C2 structure that increases effectiveness and mutually supports all members of the alliance. Perhaps the most important ingredient for success in Afghanistan is having strategic leaders with the tact, will, and skill to create an environment in which NATO can succeed. What is at stake in Afghanistan for NATO and the USA? It is hard to imagine a positive outcome with failure. Apocalypse-like scenarios seem probable if things go terribly wrong. Failure of the ISAF mission will fragment NATO, with American influence in Europe diminishing in the face of an emerging European Union army and its potential economic power. Afghanistan will certainly collapse into a failing state in a vicious civil war, dragging with it the nuclear and fragile Pakistan. Emboldening radical Islamists, now gaining inspiration from the defeat of the last superpower, will likely stimulate additional struggles and destabilize more fragile states. This is not an outcome palatable to NATO, the USA or the global community. They simply must do the hard work to create unity of effort and unity of command through capable leadership because losing is not an option.
DTIC
Afghanistan; Command and Control; Leadership; North Atlantic Treaty Organization (NATO); Security

20100018886 Naval Research Lab., Washington, DC USA
High Altitude Relay and Router
Rupar, M; Doffoh, J; Mereish, R; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518321; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Satellite and Wireless Networking Section of NRL's Transmission Technology Branch has been tasked with determining the feasibility of the use/development of communications relays held aloft by balloons at high altitude (65,000 ft above mean sea level, or MSL). The objective of this High Altitude Relay and Router (HARR) program is to extend the range of line-of-sight (LOS) communication links, particularly those compromised by terrain. The HARR project objectives

are to: (1) develop payloads capable of doing on-board routing of network traffic between multiple ground nodes within and out of line-of-sight, and (2) develop payloads capable of extending tactical communications in the UHF band for both data and voice communications for point-to-point links. NRL has developed two candidate relay platforms. The first operates in L-band using the 802.11b protocol, and incorporates a router in the sky that can direct traffic from ground site to ground site, either directly or via another balloon-based relay. Converter/amplifiers allow these routers and associated ground terminals to operate at ranges exceeding 100 miles. The second payload simulates a UHF FLTSAT payload, providing 25-kHz bent-pipe relays that can operate at SATCOM channels or LOS channels, transponding the signal to avoid self-interference. Voice at 240 miles and data at 80 miles were demonstrated using legacy UHF military systems.
DTIC
High Altitude; Radio Relay Systems; Transponders

20100018906 New Mexico Univ., Albuquerque, NM USA
Bit-Error Rate Monitor for Laser Communications
Zrilic, Djuro G; Diels, Jean-Claude; Braga, Alexandre; Mar 8, 2010; 33 pp.; In English
Contract(s)/Grant(s): FA9950-08-1-0250
Report No.(s): AD-A518388; No Copyright; Avail.: Defense Technical Information Center (DTIC)
This equipment grant has made it possible to perform the research on award FA9950-07-1-0310. A semiconductor based laser source, fiber coupled to a modulator and fiber amplifier were purchased. The system was fiber coupled to a beam director, with the possibility to launch four beams in parallel to reduce scintillation noise. A range between 10 m to 22 km can be tested with this system. The equipment grant has made it possible to train our graduate students for the first time with modern digital oscilloscopes. Real time BER estimator has been attempted using artificial neural network approach. After programming, the neural network outputs a continuous signal proportional to the bit error rate. This error level matched the reading of the bit error analyzer, only when the level of optical signal transmitted was kept at the same constant value used for the programming, and the whole optical link was bypassed. Considerable more parameters would have to be entered to the neural network program for a practical implementation to be possible.
DTIC
Bit Error Rate; Monitors; Optical Communication

20100018922 National Defense Univ., Washington, DC USA
Taking Joint Intelligence Operations to the Next Level
Akers, Tyler; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518438; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Joint Intelligence Operations Center (JIOC) at U.S. Pacific Command (USPACOM) achieved initial operational capability in January 2006. After 18 months, it is already setting a new standard for joint intelligence operations in the Pacific. Aggressive collaboration and integration with operators, planners, and the broader Intelligence Community have enhanced capability, improved predictive analysis, and, most importantly, provided operators with the intelligence support they need. Today, we continue to press for further gains in the effective execution of theater intelligence operations. Our main efforts follow two primary lines of operation. First, we focus on processes. We must continue to drive intelligence out of intel-only quarters and into venues that operators and foreign partners can use. Integrating all available intelligence into theater operations is our goal. Second, we must continue to develop a culture that empowers our talented workforce and enables us to master the intelligence environment. Effective intelligence operations depend on more than sophisticated sensor technologies. Delivering the full potential of intelligence assets requires bold analysis, innovation, and vigorous collaboration.
DTIC
Intelligence; Military Operations

20100018959 Naval Postgraduate School, Monterey, CA USA
The Implementation of Unique Item Identification for the Navy's Communications Security Equipment
Calimlim, Jeremie; Cooney, Kelly; Phan, Diane; Mar 2010; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518565; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The purpose of this project is to conduct an analysis of Unique Item Identification implementation for the Navy's Communications Security equipment. This project will review the existing inventory process and system. The team will utilize

previous papers from Naval Postgraduate School to assist in the evaluation of Return on Investment and the Knowledge Value Added analysis of the implementation.
DTIC
Communication Equipment; Financial Management; Inventories; Military Technology; Navy; Security

20100019032 National Defense Univ., Washington, DC USA
South Korea Leads the Warfight
Bell, B B; Finley, Sonya L; Jan 2007; 8 pp.; In English
Report No.(s): AD-A518765; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Republic of Korea - U.S. alliance is embarking on the most profound transformation affecting American forces on the peninsula since the Korean War. For the last 57 years, the USA has led the warfighting command responsible for the defense of the Republic of Korea (ROK). As the ROK military matured, the alliance evolved and adopted a number of command and control (C2) mechanisms integrating the ROK military into the decision-making process and command. In October 2006, the Presidents of the USA and the Republic of Korea agreed that South Korea is ready to assume primacy of its own defense in armistice, crisis, and war. In early 2007, the U.S. Secretary of Defense and ROK Minister of National Defense determined that South Korea will assume wartime operational control of its forces on April 17, 2012. The alliance is preparing to inactivate the 29- year-old warfighting Combined Forces Command (CFC) and simultaneously activate complementary national warfighting commands in 2012. U.S. Forces Korea will transform from a Title 10 oversight headquarters to U.S. Korea Command (USKORCOM), a fully capable, manned, and resourced joint warfighting command in a doctrinally supporting relationship to the ROK armed forces.
DTIC
Defense Program; Korea; South Korea

20100019152 NASA Langley Research Center, Hampton, VA, USA
Advances in HgCdTe APDs and LADAR Receivers
Bailey, Steven; McKeag, William; Wang, Jinxue; Jack, Michael; Amzajerdian, Farzin; April 05, 2010; 13 pp.; In English; SPIE Defense Security and Sensing Symposium, 5-9 Apr. 2010, Orlando, FL, USA
Contract(s)/Grant(s): NNL08AA46C; WBS 079749.04.04.04
Report No.(s): NF1676L-10445; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019152

Raytheon is developing NIR sensor chip assemblies (SCAs) for scanning and staring 3D LADAR systems. High sensitivity is obtained by integrating high performance detectors with gain i.e. APDs with very low noise Readout Integrated Circuits. Unique aspects of these designs include: independent acquisition (non-gated) of pulse returns, multiple pulse returns with both time and intensity reported to enable full 3D reconstruction of the image. Recent breakthrough in device design has resulted in HgCdTe APDs operating at 300K with essentially no excess noise to gains in excess of 100, low NEP <1nW and GHz bandwidths and have demonstrated linear mode photon counting. SCAs utilizing these high performance APDs have been integrated and demonstrated excellent spatial and range resolution enabling detailed 3D imagery both at short range and long ranges. In this presentation we will review progress in high resolution scanning, staring and ultra-high sensitivity photon counting LADAR sensors.
Author
Bandwidth; Mercury Cadmium Tellurides; Optical Radar; Chips; Integrated Circuits; Laser Range Finders; Receivers

20100019240 National Defense Univ., Washington, DC USA
The Missing Components of U.S. Strategic Communications
Darley, William M; Jan 2007; 6 pp.; In English
Report No.(s): AD-A517955; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517955

In the immediate aftermath of the 9/11 attacks, a few prescient political observers began asserting that the USA had found itself thrust into a war that would not only require military action, but also, more importantly, compel the Nation to compete in a so-called war of ideas. However, the U.S. Government was generally slow to understand the nature of the conflict, slow to acknowledge its lack of capability for dealing with such a conflict, and agonizingly slow to marshal itself robustly for that dimension of the conflict. Shockingly, almost 6 years after the attacks against the Twin Towers and Pentagon, a national-level process for organizing and conducting an effective, synchronized program aimed at countering enemy ideas is still not in place.

Therefore, many observers both in and out of government are now expressing deep concern that the USA is losing both the global war of ideas against Islamic extremists and the war on terror itself. Growing concern that we are losing the war of ideas has led to consternation and fierce debate among many offices of government over why progress has been so slow and what to do about it. But to date, this debate has produced little beyond a huge volume of PowerPoint slides, issue papers, and studies, with few actual measures taken to develop a synchronized, coordinated interagency national program?and an effort well short of the robust capabilities the USA possessed in the Central Intelligence Agency and the now-defunct U.S. Information Agency during the Cold War, both of which were key to winning the ideological dimension against Marxism/Leninism in the Soviet Union. Instead, the wrangling has focused mainly on tinkering with the mechanics of coordination, attempting to solve the problem by creating an overarching national-level coordination steering group to produce something generally described as strategic communications.
DTIC
Military Operations; Communication; Strategy

20100019352 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Handshaking Protocols and Jamming Mechanisms for Blind Rendezvous in a Dynamic Spectrum Access Environment
Gross, Aaron A; Mar. 2010; 108 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-10ENG110
Report No.(s): AD-A518397; AFIT/GCO/ENG/10-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Blind frequency rendezvous is an important process for bootstrapping communications between radios without the use of pre-existing infrastructure or common control channel in a Dynamic Spectrum Access (DSA) environment. In this process, radios attempt to arrive in the same frequency channel and recognize each other's presence in changing, under-utilized spectrum. This paper refines existing blind rendezvous techniques by introducing a handshaking algorithm for setting up communications once two radios have arrived in the same frequency channel. It then investigates the effect of different jamming techniques on blind rendezvous algorithms that utilize this handshake. The handshake performance is measured by determining the probability of a handshake, the time to handshake, and the increase in time to rendezvous (TTR) with a handshake compared to that without. The handshake caused varying increases in TTR depending on the time spent in each channel. Four different jamming techniques are applied to the blind rendezvous process: noise, deceptive, sense, and Primary User Emulation (PUE). Each jammer type is analyzed to determine how they increase the TTR, how often they successfully jam over a period of time, and how long it takes to jam. The sense jammer was most effective, followed by PUE, deceptive, and noise, respectively.
DTIC
Jamming; Protocol (Computers); Spectra

20100019354 Naval Postgraduate School, Monterey, CA USA
Optimizing C4ISR Networks in the Presence of Enemy Jamming
Andrews, Sean M; Mar. 2010; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518389; No Copyright; Avail.: Defense Technical Information Center (DTIC)

U.S. Navy forces are becoming increasingly dependent upon the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) networks that support them. This network is critical to the task of quickly putting effective weapons on important targets. Today, the delivery of weapons by U.S. Navy air and surface forces is increasingly dependent upon critical targeting information that is often provided by a network of third-party sensor and communication systems. Along with this increasing dependence is a growing threat to this network by enemy forces. Thus, an understanding of network capabilities and vulnerabilities is critical to the ability of our naval forces to successfully engage an adversary. The focus of this research is to develop a bi-level (attacker-defender) optimization model that enables us to map any current or planned C4ISR network requirements needed to execute a successful kill chain, and to uncover any vulnerabilities within the network.
DTIC
Communication Networks; Jamming; Radio Equipment

20100019390 National Renewable Energy Lab., Golden, CO USA
Fuel Cells for Backup Power in Telecommunications Facilities. Providing a Constant, Reliable Electric Power Supply
April 2009; 4 pp.; In English
Report No.(s): DE2010-952880; DOE-GO-102009-2709; No Copyright; Avail.: National Technical Information Service (NTIS)

Telecommunications providers rely on backup power to maintain a constant power supply, to prevent power outages, and

to ensure the operability of cell towers, equipment, and networks. The backup power supply that best meets these objectives is fuel cell technology. The telecommunications industry relies on an elaborate network of cell phone towers and field facilities to transmit phone calls and provide services. To operate effectively, each of these towers and field facilities requires a constant and highly reliable electrical power supply. The industry transmits voice and electronic data through wired and wireless networks.
NTIS
Fuel Cells; Industries; Telecommunication

20100019391 National Renewable Energy Lab., Golden, CO USA
Mobile Alternative Fueling Station Locator. Alternative Fuels and Advanced Vehicles Data Center. Fact Sheet
April 2009; 2 pp.; In English
Report No.(s): DE2010-952876; DOE-GO-102009-2779; No Copyright; Avail.: National Technical Information Service (NTIS)

Driving cross-country or even around town in an alternative fuel vehicle used to require work ahead of time to find the nearest fueling station--but not anymore. Consumers and fleets can now access the U.S. Department of Energys (DOE) Alternative Fueling Station Locator on-the-go using their cell phones, BlackBerrys, or other personal handheld devices. The Mobile Alternative Fueling Station Locator allows drivers to find the five closest biodiesel, electricity, E85 (ethanol), hydrogen, natural gas, and propane fueling sites. It uses familiar, easy-to-navigate Google technology to map fueling stations, list each station's contact information and business hours, and provide detailed driving directions and an instant phone connection.
NTIS
Energy Policy; Fuels; Mobile Communication Systems; Position (Location); Refueling

20100019505 Fish and Wildlife Service, Olympia, WA, USA
Pre-Spawning Adult Distribution of Queets River Spring-Summer Chinook and Feasibility of Radio Telemetry to Study Adult In-River Migration
Hiss, Joseph M.; Bigelo, Patricia E.; Hager, Stephen R.; March 1990; 24 pp.; In English
Report No.(s): PB2010-106377; No Copyright; Avail.: CASI: A03, Hardcopy

The spring portion of the Queets River chinook run is depressed. One management goal is to restore the spring component by artificially propagating the progeny of wild broodstock if they can be separated from the summer component. Thus, a primary objective of this work was to identify pre-spawning holding areas from which broodstock could be collected. The pre-spawning distribution of spring-summer chinook in the Queets River just prior to spawning was determined by snorkel survey between River Miles (R.M.) 43 and 9 in the first week of Spetember, 1989. Above average densities relative to other locations occurred in the Olympic National Park wilderness between R. M. 37.2 and R.M. 30.6 as in snorkel surveys conducted in 1987 and 1988. Many pools in this areas were suitable for netting brookstock and have adjoining gravel bars where fish could be transported to a hatchery by helicopter. the limiting factors will be turbidity, which, limits the ability of snokelers to verify fish presence before netting, and possible limits on helicopter: access prior to the first week of September by the National Park Service. A second objective was to evaluate the feasibility of radio telemetry in distinguishing spring and summer returns on the basis of holding area, spawning area, or spawn timing.
NTIS
Fishes; Migration; Radio Telemetry; Rivers

20100019542 Naval Observatory, Washington, DC USA
Some Operational Aspects of the International Two-Way Satellite Time and Frequency Transfer (TWSTFT) Experiment Using INTELSAT Satellites at 307 Degrees East
DeYoung, J A; McKinley, A; Davis, J A; Hetzel, P; Bauch, A; Dec 1995; 12 pp.; In English
Report No.(s): AD-A518236; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518236

Eight laboratories are participating in an international TWSTFT experiment. Regular time and frequency transfers have been performed over a period of almost two years, including both European and transatlantic time transfers. The performance of the regular TWSTFT sessions over an extended period has demonstrated conclusively the usefulness of the TWSTFT method for routine international time and frequency comparisons. Regular measurements are performed three times per week resulting in a regular but unevenly spaced data set. A method is presented that allows an estimate of the values of a

sigma(chi)(Tau) to be formed from these data. In order to maximize efficient use of paid satellite time an investigation to determine the optimal length of a single TWSTFT session is presented. The optimal experiment length is determined by evaluating how long white PM instabilities are the dominant noise source during the typical 300-second sampling times currently used. A detailed investigation of the frequency transfers realized via the transatlantic TWSTFT links UTC(USNO)-UTC(NPL), UTC(USNO)-UTC(PTB), and UTC(PTB)-UTC(NPL) is presented. The investigation focuses on the frequency instabilities realized, a three-cornered-hat resolution of the sigma(chi)(Tau) values, and a comparison of the transatlantic and inter-European determination of UTC(PTB)-UTC(NPL). Future directions of this TWSTFT experiment are outlined.
DTIC
Artificial Satellites; Frequencies; INTELSAT Satellites; Radioactive Decay; Telecommunication

20100019650 University of South Florida, Saint Petersburg, FL USA
Trans-Interface Optical Communication (TIOC)
Carder, Kendall L; Costello, David K; Jan 2008; 8 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0841
Report No.(s): AD-A518863; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518863

The goal of our work is to develop a system for optical communications through the sea-air interface and to provide a predictive performance model for the system for different environmental conditions, source power levels, receiver range, etc. The scientific objectives of the project involve understanding the spectral and temporal effects of water constituents and surface characteristics on trans-interface communication. This involves the development of a system that utilizes several, separated, redundant, sources to reduce the data drop-out rate due to wave refraction. Engineering objectives of the project are the design and development of an intelligent optical receiver that can identify the positions of redundant sources within video imagery and control a micro electro-mechanical system (MEMS) device to direct radiance from only those sources to a high-speed sensor for demodulation. This spatial filtering should reduce interference from surface reflection of skylight.
DTIC
Air Water Interactions; Light Emitting Diodes; Ocean Surface; Optical Communication; Seas

20100019671 Naval Air Systems Command (PMA-234), Patuxent River, MD USA
Phase Coherent Digital Communications for Wireless Optical Links in Turbid Underwater Environments
Cochenour, Brandon; Mullen, Linda; Laux, Alan; Jan 2007; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518938; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518938

Previous studies by the authors have included a theoretical and experimental investigation of the spatial distribution of an optical signal used for communications in underwater scattering environments. Presented here is an experimental study of how scattering affects the temporally encoded information bearing component of the optical signal. Short range underwater optical links employing BPSK, QPSK, 8- PSK, 16-QAM, and 32-QAM modulation are implemented in a laboratory setting, yielding data rates up to 5Mb/s. The effect of link quality is examined versus water turbidity.
DTIC
Communication Networks; Pulse Communication; Wireless Communication

20100019735 Ocean Design, Inc., Daytona Beach, FL USA
Undersea Distributed Networked System: An Enabling Power and Communications Infrastructure Technology
Bennett, Robert L; Evangelides, Stephen G; Morreale, Jay P; Symonds, Darryl R; Henson, Joshua I; Wilson, Jeffrey V; Jan 2007; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519090; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519090

Monitoring the ocean, whether for defense, port security or oceanographic and climatological purposes is becoming increasingly important. As a result there is need for a flexible, reliable, economical and easy way to deploy infrastructure for providing power and communication pathways to sensor arrays. In this paper we will describe three key subsystems which, when combined with standard undersea telecom cable and commercially available connectors, create a complete infrastructure to support an undersea array of sensors.
DTIC
Communication Networks; Underwater Communication

20100019743 Army Research Lab., Aberdeen Proving Ground, MD USA

Guidelines for Head Tactile Communication

Myles, Kimberly; Kalb, Joel T; Mar 2010; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-6102A74A

Report No.(s): AD-A519112; ARL-TR-5116; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519112

A helmet-mounted tactile display is desired for military applications such as cueing to alert Soldiers to the direction and location of an event or indicating movement direction in GPS-supported navigation. However, the system must be compatible with the head sensitivity of the user to ensure the user's optimal perception of the provided information. The purpose of this report is to document the overall findings of the basic research program regarding head tactile sensitivity and to provide answers to two basic questions: (1) What locations on the head are most sensitive to vibration stimulation? (2) What is the optimal frequency for tactile signals to be applied to the head? The overall findings are discussed and are considered as initial guidelines for head tactile communication and for using vibration stimulation on the head.

DTIC

Display Devices; Sensitivity; Vibration

20100019781 National Inst. of Standards and Technology, Gaithersburg, MD USA

Odds of Successful Transfer of Low-level Concepts: A Key Metric for Bidirectional Speech-to-Speech Machine Translation in DARPA's TRANSTAC Program

Sanders, Gregory A; Bronsart, Sebastien; Condon, Sherri; Schlenoff, Crsig; Jan 2008; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519222

The Spoken Language Communication and Translation System for Tactical Use (TRANSTAC) program is a Defense Advanced Research Agency (DARPA) program to create bidirectional speech-to-speech machine translation (MT) that will allow U.S. Soldiers and Marines, speaking only English, to communicate, in tactical situations, with civilian populations who speak only other languages (for example, Iraqi Arabic). A key metric for the program is the odds of successfully transferring low-level concepts, defined as the source-language content words. The National Institute of Standards and Technology (NIST) has now carried out two large-scale evaluations of TRANSTAC systems, using that metric. In this paper we discuss the merits of that metric. It has proven to be quite informative. We describe exactly how we defined this metric and how we obtained values for it from panels of bilingual judges--allowing others to do what we have done. We compare results on this metric to results on Likert-type judgments of semantic adequacy, from the same panels of bilingual judges, as well as to a suite of typical automated MT metrics (BLEU, TER, METEOR).

DTIC

Machine Translation; Speech; Translating

20100019891 Cornell Univ., Ithaca, NY USA

Ultra Low Power for Ad-Hoc Sensing Networks W31P4Q-08-1-0011

Apsel, Alyssa; Mar 9, 2010; 7 pp.; In English

Contract(s)/Grant(s): W31P4Q-08-1-0011

Report No.(s): AD-A519386; OSP-56484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes progress towards the development of radio networks with ultra-low power requirements in the range of self-powered systems and networking capabilities that are both scalable and ad-hoc. As indicated in the following sections we have achieved many of our projected milestones including demonstration of record breaking low power transmitter and receiver front ends that are robust, CMOS compatible, process tolerant, and FCC compliant at less than 20uW. At the same time, we encountered significant challenges in the design and demonstration of timing and synchronization blocks. While we were able to demonstrate synchronization of more than two radios with jitter levels better than 0.1 percent proposed, we realized that circuit level improvements needed to be initiated to demonstrate the level of timing certainty of which the system is ultimately capable. As a result of this first year of effort, we have learned many key lessons and are forging a path forward to a network of radios capable of duty cycled operation with power levels an order of magnitude lower than any comparable system shown to date and with scalability previously not considered possible in other radio networks.

DTIC

CMOS; Communication Networks; Detection; Radio Equipment

20100019973 Massachusetts Inst. of Tech., Lexington, MA USA

Secure Channel Establishment in Disadvantaged Networks: TLS Optimization Using Intercepting Proxies

McVeety, Sam; Khazan, Roger; Cooley, Joseph; Aug 18, 2009; 73 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A519567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Transport Layer Security (TLS) is a secure communication protocol that is used in many secure electronic applications. In order to establish a TLS connection, a client and server engage in a handshake, which usually involves the transmission of digital certificates. In this thesis we develop a practical speedup of TLS handshakes over bandwidth-constrained, high-latency (i.e. disadvantaged) links by reducing the communication overhead associated with the transmission of digital certificates. This speedup is achieved by deploying two specialized TLS proxies across such links. Working in tandem, one proxy will replace certificate data in packets being sent across the disadvantaged link with a short reference, while the proxy on the other side of the link will restore the certificate data in the packet. The certificate data will be supplied by local or remote caches. Our solution preserves the end-to-end security of TLS and is designed to be transparent to third-party applications, and will thus facilitate rapid deployment by removing the need to modify existing installations of TLS clients and TLS servers. Testing shows that this technique can reduce the overall bandwidth used during a handshake by over 50%, and can reduce the time required to reestablish a secure channel by over 40% across Iridium links.

DTIC

Coding; Interception

20100019974 Massachusetts Inst. of Tech., Lexington, MA USA

Optimizing Secure Communication Standards for Disadvantaged Networks

Okano, Stephen H; Khazan, Roger; Cooley, Joseph; Fuller, Benjamin; Sep 1, 2009; 142 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A519569; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present methods for optimizing standardized cryptographic message protocols for use on disadvantaged network links. We first provide an assessment of current secure communication message packing standards and their relevance to disadvantaged networks. Then we offer methods to reduce message overhead in packing Cryptographic Message Syntax (CMS) structures by using ZLIB compression and using a Lite version of CMS. Finally, we offer a few extensions to the Extensible Messaging and Presence Protocol (XMPP) to wrap secure group messages for chat on disadvantaged networks and to reduce XMPP message overhead in secure group transmissions. We present the design and implementation of these optimizations and the results that these optimizations have on message overhead, extensibility, and usability of both CMS and XMPP. We have developed these methods to extend CMS and XMPP with the ultimate goal of establishing standards for securing communications in disadvantaged networks.

DTIC

Communication Networks

20100019976 Massachusetts Inst. of Tech., Lexington, MA USA

2-D Processing of Speech for Multi-Pitch Analysis

Wang, Tianyu T; Quatierei, Thomas F; Sep 2009; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A519574; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper introduces a two-dimensional (2-D) processing approach for the analysis of multi-pitch speech sounds. Our framework invokes the short-space 2-D Fourier transform magnitude of a narrowband spectrogram, mapping harmonicallyrelated signal components to multiple concentrated entities in a new 2-D space. First, localized time-frequency regions of the spectrogram are analyzed to extract pitch candidates. These candidates are then combined across multiple regions for obtaining separate pitch estimates of each speech-signal component at a single point in time. We refer to this as multi-region analysis (MRA). By explicitly accounting for pitch dynamics within localized time segments, this separability is distinct from that which can be obtained using short-time autocorrelation methods typically employed in state-of-the-art multi-pitch tracking algorithms. We illustrate the feasibility of MRA for multi-pitch estimation on mixtures of synthetic and real speech.

DTIC

Speech; Voice Communication

20100019978 Massachusetts Inst. of Tech., Lexington, MA USA
Towards Co-Channel Speaker Separation by 2-D Demodulation of Spectrograms
Wang, Tianyu T; Quatieri, Thomas F; Oct 21, 2009; 5 pp.; In English
Contract(s)/Grant(s): FA8721-05-C-0002
Report No.(s): AD-A519581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper explores a two-dimensional (2-D) processing approach for co-channel speaker separation of voiced speech. We analyze localized time-frequency regions of a narrowband spectrogram using 2-D Fourier transforms and propose a 2-D amplitude modulation model based on pitch information for single and multi-speaker content in each region. Our model maps harmonically-related speech content to concentrated entities in a transformed 2-D space, thereby motivating 2-D demodulation of the spectrogram for analysis/synthesis and speaker separation. Using a priori pitch estimates of individual speakers, we show through a quantitative evaluation: 1) Utility of the model for representing speech content of a single speaker and 2) Its feasibility for speaker separation. For the separation task, we also illustrate benefits of the model's representation of pitch dynamics relative to a sinusoidal-based separation system.
DTIC
Demodulation; Spectrograms

20100019988 National Defense Univ., Washington, DC USA
News Media and Strategic Communications Industry, Industry Study, Spring 2008
Ahlgrimm, James M; Andrews, Nancy K; Binder, Martin G; Eckardt, John P; Ey, Carl S; Feeley, Annette P; Festa, Lisa M; Guden, Johnatan C; Ingram, Andrew D; LaCoss, Scott D; Lopez, Stephanie; Love, Steven B; McClanahan, Patrick J; Munchmeyer, Katherine A; Rieping, Jr , Heinrich K; Sauerwalt, Robert E; Van Belle, Patricia D; Watkins, Tracey L; Jan 2008; 36 pp.; In English
Report No.(s): AD-A519608; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The news media industry and the U.S. national security strategy have been inextricably linked since the founding of the country, when newspaper articles became the medium for widespread public discussion. In the globalized 21st century, the news media industry plays an increasingly important role in questioning, evaluating, informing, influencing and disseminating the stories and events important to American life, the American democracy and America's national security. Faced with competitive pressures, changing consumer preferences, market fragmentation and dwindling profits, the preeminence of America's traditional news media industry is in jeopardy. Emerging business strategies facing the news media industry demand that leaders improve the quality of news coverage to maintain the trust with its customer base. The focus on the quality of the news may determine whether it can remain viable in a competitive market. Regardless of the media platform, the production of objective, credible, and timely news content is a necessary prerequisite to financial viability. News providers must establish their core competencies and expend the resources necessary to provide a quality product. Also key to the news media industry's survival is the acceptance of new, non-traditional players in the field of journalism. Rather than decry the growing band of bloggers and citizen journalists, the industry must continue to find new means to leverage those who uphold journalistic values of objectivity and credibility as news providers. Lastly, our democracy and the freedoms it automatically confers upon its? citizens demands that information produced by the USA government is credible news and not propaganda. By encouraging and facilitating the free flow of information and ideas between the public, the news media industry and the government, we ensure that our national dialogue is as unfettered and vibrant as the Founding Fathers hoped it would be.
DTIC
Industries; News Media; Security

20100020139 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Amsterdam Univ., Netherlands
M/G/Infinity Transience, and Its Applications to Overload Detection
Mandjes, Mark R. H.; Zuraniewski, Piotr; May 14, 2009; 22 pp.; In English; Original contains color illustrations
Report No.(s): PB2010-108108; PNA-E0910; Copyright; Avail.: National Technical Information Service (NTIS)

When controlling communication networks, it is of crucial importance to have procedures that are capable of checking whether there are unanticipated load changes. In this paper we develop techniques for detecting such load changes, in a setting in which each connection consumes roughly the same amount of bandwidth (with VoIP as a leading example). For the situation of exponential holding times an explicit analysis can be performed in a large-deviations regime, leading to approximations of the test statistic of interest (and, in addition, to results for the transient of the M/M/1 queue, which are of independent interest). This procedure being applicable to exponential holding times only, and also being numerically rather involved, we then develop an approximate procedure for general holding times. In this procedure we record the number of trunks occupied at equidistant points in time delta, 2 delta, etc., where delta is chosen sufficiently large to safely assume that the samples are

independent; this procedure is backed by results on the transient of the M/G/infinity queue, thus complementing earlier results on relaxation times. The validity of the testing procedures is demonstrated through an extensive set of numerical experiments.
NTIS
Communication Networks; Detection; Network Control; Transmission Efficiency

20100020222 Naval War Coll., Newport, RI USA
'A Striking Thing': Leadership, Strategic Communications, and Roosevelt's Great White Fleet
Holmes, James R; Jan 2008; 19 pp.; In English
Report No.(s): AD-A519197; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519197

The voyage of the U.S. Navy's Great White Fleet constituted an exercise in personal leadership on the part of President Theodore Roosevelt and in international leadership on the part of a USA announcing its arrival as a world power. Sixteen battleships, eight armored cruisers, six torpedo-boat destroyers, and associated auxiliaries steamed out of Hampton Roads in December 1907, embarking on a world cruise.1 The fleet rounded South America before standing out across the Pacific, stopping at a variety of ports of call along the way. It passed through Malacca, the Bab el Mandeb, Suez, and Gibraltar before returning home through the Atlantic. The vessels entered harbor in early 1909, allowing TR to conclude his presidency on a triumphant note.2
DTIC
Leadership; Strategy; Telecommunication

20100020228 National Defense Univ., Washington, DC USA
On the Nature of Strategic Communications
Lord, Carnes; Jan 2007; 4 pp.; In English
Report No.(s): AD-A519479; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Strategic communications, as now generally understood within the Department of Defense (DOD), encompass (to use the bureaucratic terms of art) public affairs, defense support for public diplomacy, and military psychological operations (PSYOP). That there has been something less than smooth cooperation among these various components is hardly a secret. In the fall of 2001, for instance, the Pentagon established an Office of Strategic Influence (OSI) with significant funding of its own to plan and coordinate a joint and coalition campaign to shape the communications battlefield in the war on terror. This promising initiative promptly blew up. In early 2002, Secretary Donald Rumsfeld felt compelled to disestablish OSI when press accounts alleged that the office was placing so-called disinformation in the American media (later investigation showed the charges to be false or grossly misleading). Evidently, these attacks were inspired from within the Pentagon itself by elements of the DOD public affairs community. Continuing tension between the PSYOP and public affairs communities over the fundamental nature of strategic communications remains perhaps the most serious impediment to more effective action by the Defense Department in this critical arena.
DTIC
Strategic Materials; Warfare; Telecommunication

20100020257 Aptima, Inc., Woburn, MA USA; State Univ. of New York, Albany, NY, USA
Implementing the Cultural Dimension into a Command and Control System
Grier, Rebecca A.; Skarin, Bruce; Wolpert, Lawrence; Lubyansky, Alexander; March 2008; 9 pp.; In English; AFCEA-GMU C4I Center Symposium: Critical Issues in C4I, 20-21 May 2008, Fairfax, VA, USA
Contract(s)/Grant(s): FA8650-06-C-6634; Proj-3005
Report No.(s): AD-A518842; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518842

Current command and control (C2) operations are centered on addressing the root causes of state failure and instability. For success, these C2 operations require the cooperation of local populations and governments. To win this cooperation, we need to be able to predict changes in the opinions of local populations. Cultural identity is a critical factor in this process. These cultural identities are multi-layered and dynamic. In order to predict the impact of events on a population's attitude, one must remember that each person has several different identities and that some of these identities may change. Further people's attitudes change based on their contact with other individuals. When people's attitudes change, then their participation in groups changes as well. SCIPR (Simulation of Cultural Identities for Prediction of Reactions) is an agent based computer simulation that forecasts the effects of actions on peoples' opinions and cultural identities to better model the underlying forces

driving attitude based conflicts. In this paper, we will describe the development of the SCIPR model and its application for current C2 operations.
DTIC
Command and Control; Computerized Simulation; Identities; Populations

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ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20100018402 National Taiwan Univ. Hospital, Taipei, Taiwan, Province of China
The Development of an 8 x 8 Optical Switch
Yang, Yao-Joe; Liao, Bo-Ting; Shih, Sun-chih; Fan, Kuang-Chao; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 37-43; In English; See also 20100018398
Contract(s)/Grant(s): NSC 96-222 1-E-002-063; Copyright; Avail.: Other Sources

In this paper, a novel 8 x 8 optical switch, which consists of a MEMS-based silicon micro-mirror array and a solenoid-based bi-stable mini-actuator array, is presented. The silicon micro-mirror array is realized by using a single-step anisotropic silicon etching process . The anisotropic silicon etching technique is capable of fabricating the self-aligned micro-mirror array with high accuracy and high fabrication yield. The mini-actuator array comprises 64 electromagnetic solenoid-based bistable actuator integrated with pushing arms. Each micro-mirror, which is connected to the substrate by a cantilever, can be individually actuate d by a mini-actuator. Because of the bi-stability of the mini-actuator, the power consumption of the system can be significantly reduced. When the pushing arm does not contact the cantilever, the micro-mirror which is under zero external force can precisely reflect optical signals. When the pushing arm pushes up the micro-mirror, the optical signal passes through under the mirror. The main advantages of this proposed switch include high precision, high fabrication yield, low actuation voltage, low cost, low power consumption, and easy fiber alignment. The optical performance and the dynamic response of the switch are all investigated. The measured insertion loss is about -2.2 too approx. -3.3 dB, cross-talk is less than -60 dB , and the measured switching time is less than 12 ms .
Author
Actuators; Mirrors; Switches; Microoptoelectromechanical Systems; Optoelectronic Devices; Optical Switching

20100018411 National Taipei Univ. of Education, Taipei, Taiwan, Province of China
Precision Recovery Fabrication Using a Cylinder-Form Tool
Pa, Pai-Shan; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 81-87; In English; See also 20100018398
Contract(s)/Grant(s): NSC 95-2622-E-152-00 I-CC3; NSC 96-2622-E-152-00 I-CC3; Copyright; Avail.: Other Sources

A precision recovery fabrication of Indium-tin-oxide (ITO) removal from the color filter surface of an optoelectronic flat panel display using electroremoval with a cylindrical tool is demonstrated. Through the ultra-precise removal of the thin-fi1m microstructure, the optoelectronic semiconductor industry can effectively recycle defective products, thereby reducing production cost. In the current electrochemical machining experiment, the author uses a fifth-generation Thin-Film Transistor Liquid- Crystal Display (TFT-LCD) in conjunction with continuous and pulsed direct current. The surface roughness remains constant before ITO evaporation to the surface of the display's color filters and after the ITO layer is removed through the electroremoval process. A cylindrical tool of small diameter is found to provide an effective current density and a better removal effect while a high rotational speed of the cylindrical tool and an adequate flow velocity of the electrolyte elevate the discharge mobility and also improve the removal effect. Pulsed direct current may improve the effect of dreg discharge and is positively correlated with the fast feed rate of the workpiece. A display's color filter with a fast feed rate is combined with enough electric power to provide highly effective removal. A precision recycling process is presented using an effective cylindrical tool for electrochemical removal. Finally, only a short period of time is required to remove the ITO layer easily and cleanly.
Author
Cylindrical Bodies; Electrochemical Machining; Flat Panel Displays; Microstructure; Precision; Semiconductors (Materials); Thin Films

20100018493 Impact Technologies, LLC, Tulsa, OK, USA
Advanced Mud System for Microhole Coiled Tubing Drilling
Oglesby, Kenneth; December 01, 2008; 84 pp.; In English
Contract(s)/Grant(s): DE-FC26-04NT15476
Report No.(s): DE2009-964181; No Copyright; Avail.: National Technical Information Service (NTIS)

An advanced mud system was designed and key components were built that augment a coiled tubing drilling (CTD) rig that is designed specifically to drill microholes (less than 4-inch diameter) with advanced drilling techniques. The mud system was tailored to the hydraulics of the hole geometries and rig characteristics required for microholes and is capable of mixing and circulating mud and removing solids while being self contained and having zero discharge capability. Key components of this system are two modified triplex mud pumps (High Pressure Slurry Pumps) for advanced Abrasive Slurry Jetting (ASJ) and a modified Gas-Liquid-Solid (GLS) Separator for well control, flow return and initial processing. The system developed also includes an additional component of an advanced version of ASJ which allows cutting through most all materials encountered in oil and gas wells including steel, cement, and all rock types. It includes new fluids and new ASJ nozzles. The jetting mechanism does not require rotation of the bottom hole assembly or drill string, which is essential for use with Coiled Tubing (CT). It also has low reactive forces acting on the CT and generates cuttings small enough to be easily cleaned from the well bore, which is important in horizontal drilling. These cutting and mud processing components and capabilities compliment the concepts put forth by DOE for microhole coiled tubing drilling (MHTCTD) and should help insure the reality of drilling small diameter holes quickly and inexpensively with a minimal environmental footprint and that is efficient, compact and portable. Other components (site liners, sump and transfer pumps, stacked shakers, filter membranes, etc..) of the overall mud system were identified as readily available in industry and will not be purchased until we are ready to drill a specific well.

NTIS
Drilling; Mud; Natural Gas; Pipes (Tubes)

20100018509 National Center for Environmental Research, Washington, DC, USA
Proceedings of the Interagency Environmental Nanotechnology Grantee Workshop, November 19-21, 2008, Sheraton Tampa Riverwalk Hotel, Tampa, FL
November 2008; 308 pp.; In English
Report No.(s): PB2010-107607; No Copyright; Avail.: National Technical Information Service (NTIS)

The abstracts contained in this document are a combination of abstracts that were taken from the EPA Web Site and submitted by presenters. The abstracts taken from the EPA Web Site may not reflect the presentation but only the scope of the project.

NTIS
Nanotechnology; Environment Protection

20100018515 Fish and Wildlife Service, Olympia, WA, USA
Travel Time of Coho Salmon and Steelhead Smolts Emigrating through Howard Hanson Reservoir, King County, Washington
April 1996; 64 pp.; In English
Report No.(s): PB2010-106364; No Copyright; Avail.: CASI: A04, Hardcopy

We radio tagged, with gastric implants, 110 coho salmon (Oncorhynchus kisutch) and 106 steelhead (O.0mykiss) smolts to (1) assess whether Howard Hanson Reservoir pool size affects smolt emigration and, (2) predict the effect of the proposed additional reservoir storage on smolt travel time. Each spring, the reservoir is refilled for low flow augmentation and increases from 1.3 miles (thalweg measure) to 4.1 miles in length, which may delay emigrating smolts. Under the proposed additional reservoir storage condition, the reservoir would increase to 5.2 miles in total length (thalweg measure) at full pool. Radio-tagged coho salmon and steelhead smolts were released upstream of the reservoir at existing low, mid, and full pools and their movement was tracked with fixed and mobile receivers to the dam's forebay. Over the refill cycle, both species exhibited similar patterns in travel time but coho salmon to the forebay at mid pool (11.0 days) was significantly greater ($p < 0.001$) than their mean travel time at low pool (3.1 d) or full pool (6.0 d). Likewise, mean travel time of steelhead to the forebay at mid pool (7.4 d) was significantly greater ($p < 0.001$) than their mean travel time at low pool (2.9 d) or full pool (2.7 d). However, mean travel time of coho salmon was significantly greater than steelhead at mid pool ($P=0.004$) and full pool ($P < 0.001$) but not significantly different at low pool.

NTIS
Fishes; Migration; Reservoirs; Washington

20100018600 Minnesota Univ., Minneapolis, MN USA
Uncooled Tunable LWIR Microbolometer
Talghader, Joseph J; May 5, 2010; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-03-1-0343
Report No.(s): AD-A517537; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517537

Uncooled infrared detection has given the USA military one of its most significant advantages of recent decades. However, this technology has spread to countries across the globe, and US superiority is no longer assured. However, uncooled detectors have significant potential capabilities that have been little explored. Cooled detectors completely dominate narrowband sensing applications, such as in target recognition or chemical identification. This is probably because thermal detectors have traditionally been designed to absorb across the entire thermal infrared and the materials traditionally chosen to absorb do not lend themselves to spectral selectivity.
DTIC
Bolometers; Cooling; Far Infrared Radiation; Thermodynamic Properties

20100018684 Naval Research Lab., Washington, DC USA
Mobility Enhancement in Strained Antimonide Quantum Wells
Bennett, B R; Boos, J B; Ancona, M G; Papanicolaou, N; Champlain, J G; Bass, R; Shanabrook, B V; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517873; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517873

Low-power electronics is essential for a number of military and commercial applications. Previous work at NRL has demonstrated high-performance, low-power, antimonide-based compound semiconductor transistors. In these devices, InAs is used as an electron channel with mobilities as high as 30,000 cm2/V-s at room temperature. This work has been transitioned to industry for analog applications, resulting in X-band and W-band low-noise amplifiers with record low power consumption (a factor of 3 and 10 lower than InP- and GaAs-based amplifiers, respectively). For digital and mixed-signal applications, power consumption can be minimized by designing circuits with complementary n(electron)- and p(hole)-channel transistors. These circuits consume negligible power except when being switched. Military applications for this technology are expected to include high-speed analog-to-digital conversion for high-performance radar and miniature air vehicles (MAVs), autonomous sensing, and application-specific integrated circuits (ASICs).
DTIC
Antimonides; Augmentation; Mobility; Quantum Wells; Transistors

20100018687 Naval Research Lab., Washington, DC USA
Measurement and Analysis of Clutter in Electronic Displays
Lohrenz, M C; Beck, M R; Trafton, J G; Gendron, M L; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517879; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517879

Electronic geospatial displays are common-from aircraft moving-maps to handheld GPS devices. As new data sources become available, users are tempted to display everything of interest: digital charts, satellite imagery, weather data, etc. The ensuing clutter can impact a user's ability to access, interpret, and effectively use the displayed information. This paper presents a model of display clutter comprised of global and local components, which we compared with subjective clutter ratings and target search performance. Our results suggest strong correlations between our global clutter metric and subjective ratings, and between our local clutter metric and search performance.
DTIC
Clutter; Display Devices; Electronic Equipment; Meteorological Parameters; Satellite Imagery

20100018725 Naval Research Lab., Washington, DC USA
High-Power Fiber Lasers for Directed-Energy Applications
Sprangle, P; Ting, A; Penano, J; Fischer, R; Hafizi, B; Jan 2008; 12 pp.; In English
Report No.(s): AD-A517983; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517983

High-power fiber lasers can be incoherently combined to form the basis of a high-energy laser system for directed-energy

applications. These applications include tactical directed energy and power beaming. Incoherent combining of fiber lasers has a number of advantages over other laser beam combining methods. The incoherently combined laser system is relatively simple, highly efficient, compact, robust, low-maintenance, and reliable. In this article, we characterize the atmospheric propagation of incoherently combined, high optical quality laser beams and compare them with other types of laser beams and combining methods. For tactical directed-energy applications, we find that the propagation efficiency of incoherently combined high optical quality beams is near the theoretical upper limit for any laser system with the same beam director and total power. We present results of the first atmospheric propagation experiments using incoherently combined, kilowatt-class, single-mode fiber lasers. These NRL field experiments combined four fiber lasers using a beam director consisting of individually controlled steering mirrors. The transmitted continuous-wave power was 3 kW at a range of 1.2 km with a demonstrated propagation efficiency of tilde 90% in moderate atmospheric turbulence. The experimental results are found to be in good agreement with simulations and theory.
DTIC
Fiber Lasers; Fiber Optics; High Power Lasers; Lasers

20100018730 Naval Research Lab., Washington, DC USA
Generalized FFT Beamsteering
Coleman, J O; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517994; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517994

A receive antenna's beam, the direction of maximum gain or sensitivity, need not be rigidly oriented to the physical antenna. An array antenna, hundreds or thousands of small antenna elements laid out along a line or, more usefully, on a 2D lattice, offers an electronically controlled, agile beam or even multiple beams associated with multiple antenna outputs, a technology that can enable a military radar to precisely track many objects in flight simultaneously. The classic approach to efficiently realizing many simultaneous beams uses fast Fourier transforms (FFTs) for computational efficiency but severely restricts choices of system parameters. Generalized FFT beamsteering as described here loosens those restrictions to give system designers a larger tradeoff space and therefore opportunities for cost savings and performance gains, particularly for large digital radar arrays.
DTIC
Antenna Arrays; Beam Steering; Beamforming; Beams (Radiation); Fast Fourier Transformations; Steering

20100018731 Naval Research Lab., Washington, DC USA
Dynamics of Forward Voltage Drift in 4H-SiC PiN Diodes
Caldwell, J D; Stahlbush, R E; Hobart, K D; Glembocki, O J; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517995; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517995

4H-silicon carbide (SiC) is desired for electronic devices designed to be operated at high temperatures or at high electric powers. However, difficulties in the growth of high-purity, low defect density substrates and epitaxial layers have limited the use of SiC in commercial and military applications. One such impediment is the nucleation and expansion of Shockley stacking faults (SSFs) during forward-bias device operation (stressing), which induces an undesirable increase in the forward voltage drop (Vf). While efforts have been made to reduce the number of SSFs within a given device, these defects continue to provide a significant technological hurdle to the commercialization of 4H-SiC electronic devices, most especially for larger-area power devices that require close to defect-free active regions.
DTIC
Crystal Defects; Electric Potential; Junction Diodes; P-I-N Junctions; Silicon Carbides

20100018734 Naval Research Lab., Washington, DC USA
Graded Bandgap Type-II Superlattice Photodiodes
Aifer, E H; Vurgaftman, I; Canedy, C L; Jackson, E M; Tischler, J G; Warner, J H; Stine, R; Meyer, J R; Whitman, L J; Jan 2008; 4 pp.; In English
Report No.(s): AD-A518003; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518003

An infrared focal plane array (IRFPA) is a dense array of sensors and readout circuitry that creates the image in an infrared camera. are at the core of infrared detector systems for finding and tracking missiles in space, guiding missile seekers, seeing

in the dark, mapping ocean temperatures, and defeating camouflage and decoys. For the past decade, continuous improvement of based on mercury cadmium telluride have dramatically enhanced performance and expanded capabilities in the mid-wave (3-5 micrometers) and long-wave (8-14 micrometers) infrared (MWIR and LWIR) bands. However, further improvements demanded by the next generation of detector systems are driving investigations of other material systems. A promising material system for the next generation of is the type-II superlattice (T2SL) lattice-matched to. Although the detector concept was proposed over 30 years ago, only in the last few years has this design begun to demonstrate its potential. researchers have been at the forefront, making key innovations including the W-structured T2SL (WSL), the graded bandgap T2SL photodiode, and most recently, shallow-etch mesa isolation.
DTIC
Energy Gaps (Solid State); Focal Plane Devices; Infrared Detectors; Infrared Radiation; Photodiodes; Superlattices

20100018747 Colorado Univ., Boulder, CO USA
Frequency and Phase Break Detection
Czopek, Scott; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518031; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518031

A phase break detection method is proposed and successfully tested for the CANVAS analysis software for frequency standards. Phase breaks are detected above the noise floor by classifying a very large phase step as a phase break. This detection method succeeds in numerically quantifying a large visual jump in the phase plot without using input parameters other than the phase data. These phase breaks are automatically identified by the software, and then are removed from the data. To implement this solution, it is assumed that the frequency standard is well behaved. The most extreme phase steps (1% of the total data) are assumed to contain all phase breaks and other misbehaving data points, and this small subset of 1% is neglected during the detection method's preliminary analysis. If these assumptions are violated, then this phase-break detection method does not apply to the set. The phase-break detection algorithm still needs to be interfaced with the CANVAS user interface. Also, this method and the frequency-break detection method are intended for post-process use. A frequency-break detection method is also proposed, and the assumptions that invalidate the method are explained.
DTIC
Detection; Frequency Measurement; Frequency Standards; Phase Detectors

20100018775 Sandia National Labs., Albuquerque, NM USA
Micro Ion Frequency Standard
Schwindt, P D; Olsson, R; Wojciechowski, K; Serkland, D; Statom, T; Partner, H; Biedermann, G; Fang, L; Casias, A; Manginell, R; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518088; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518088

We are developing a highly miniaturized trapped ion clock to probe the 12.6 GHz hyperfine transition in the (sup 171)Yb+ ion. The clock development is being funded by the Integrated Micro Primary Atomic Clock Technology (IMPACT) program from DARPA, where the stated goals are to develop a clock that consumes 50 mW of power, has a size of 5 cubic cm, and has a long-term frequency stability of 10(exp -14) at 1 month. Trapped ion systems are an excellent candidate for such extreme miniaturization, because ions are well isolated from the environment independently of the size of the trap. Trapped ion clocks are characterized by quality factors, Q, in excess of 10(exp 12) and excellent long-term stability, and the Q will be minimally degraded upon miniaturization. To realize the clock in a small package will require the miniaturization of several technologies. One of the primary technologies will be the miniaturized ion trap and vacuum package. Linear RF Paul traps routinely have dimensions of a couple millimeters, but miniaturizing the vacuum package with an integral trap, Yb source, and pump will require a novel design. Integrating the miniature, low-power light sources for state detection at 369 nm and 935 nm and for photoionization at 399 nm will also be critical. The 369 nm laser will be a frequency-doubled vertical external cavity surface-emitting laser (VECSEL). A low-phasenoise local oscillator at 12.6 GHz will also be developed using a micro resonator based on exciting acoustic resonances in aluminum nitride. We will present our proposed approach to developing the micro ion frequency standard and relevant current results.
DTIC
Atomic Clocks; Frequency Standards; Ions; Laser Cavities; Microelectronics; Surface Emitting Lasers; Trapped Particles; Ytterbium

20100018776 National Inst. of Standards and Technology, Boulder, CO USA

Phase-Lock Loops in Vibration Environments

Hati, A; Nelson, C W; Howe, D A; Nov 2009; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518089; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518089

A popular scheme for achieving low phase noise across a large range of offset frequencies is to employ an oscillator at an output frequency with low far-from-carrier noise that is phase-locked to a reference that has low close-to-carrier noise. We investigate the effects of vibration on phase-locked loop (PLL) when two oscillators with different vibration sensitivity are phase-locked. For experimental verification, a 2.5-GHz surface-transverse wave (STW) oscillator integrated with and phase-locked to a reference 10-MHz quartz-crystal oscillator is chosen. The vibration sensitivity of a STW oscillator used for the experiment is slightly lower than the vibration sensitivity of the 10-MHz reference. The PLL is optimized for at-rest operation and then evaluated in the presence of different levels of random vibration.

DTIC

Crystal Oscillators; Loops; Phase Locked Systems; Sound Waves; Surface Acoustic Wave Devices; Surface Waves; Time Measurement; Transverse Waves; Vibration

20100018777 SP Technical Research Inst. of Sweden, Boras, Sweden

Fiber-Based Frequency Distribution Based on Long-Haul Communication Lasers

Ebenhag, Sven-Christian; Hedekvist, Per O; Jaldehag, Kenneth; Nov 2009; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518090; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518090

Resent research and development of optical clocks has increased the need and requirement of better performing time and frequency transfer over baselines longer than 100 km. This need has resulted in a lot of activities in transfer methods using optical fiber, some of them in dedicated fibers and others in already existing fiber networks. This study has focused on one-way transmission over a fiber-optic WDM network. The results show that it is possible to perform a one-way time and frequency transfer with two wavelengths and, by evaluating these two against each other, create a correction signal for compensation for influences along the transmission path. This experiment has shown proof of concept, but further work is needed. Future work includes development of a physical correction component in the end of the link that incorporates the steering signal from the difference between the two wavelengths.

DTIC

Fiber Optics; Frequency Distribution; Lasers; Optical Communication; Time Measurement; Transmission Lines; Wavelength Division Multiplexing

20100018821 Naval Research Lab., Washington, DC USA

IR Photonic Bandgap Fibers for Missile Defense

Aggarwal, I D; Sanghera, J S; Gibson, D; Kung, F; Busse, L E; Shaw, L B; Nguyen, V Q; Pureza, P C; Jan 2007; 3 pp.; In English

Report No.(s): AD-A518226; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518226

IR-transmitting fibers fabricated at the Naval Research Laboratory (NRL) have low optical loss (tilde 0.2 dB/m) and have been successfully used in aircraft missile defense system demonstrations for the 2 to 5 micrometer region to replace bulk optics connecting the laser to the jam head as well as being wired inside the jam head. These conventional, solid-core fibers result in significant weight reduction. They reduce system size and complexity as well as cost of both installation and maintenance, and are capable of laser power input typical of current systems. However, advanced infrared threats require much higher laser power, which these solid-core fibers cannot tolerate.

DTIC

Energy Gaps (Solid State); Fiber Optics; Lasers; Missile Defense; Photonics; Silica Glass

20100018824 Naval Research Lab., Washington, DC USA

Real-Time Fleet Protection

Smith, L N; Waterman, J R; Jan 2007; 4 pp.; In English

Report No.(s): AD-A518229; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518229

Recent advances in infrared sensor technology, detection algorithms, and high performance commercial computing

hardware have enabled powerful new approaches to autonomous day/night video imaging-based protection systems for Navy surface ships. Under the ONR Fleet and Force Protection Future Naval Capabilities program, NRL has developed the Distributed Aperture System Infrared Search and Track (DAS IRST) system for that purpose. The DAS IRST system provides situational awareness against terrorist-class threats such as surfaced divers, rafts, small boats, and light aircraft, and covert surveillance capability, including autonomous detection, tracking, and threat designation for antiship missiles. The performance characteristics of the system are superior to prior implementations as the result of the development very-large-format high-sensitivity infrared focal planes and improved real-time detection, tracking, and threat declaration algorithms.
DTIC
Apertures; Distributed Processing; Infrared Detectors; Infrared Radiation; Infrared Tracking; Protection; Real Time Operation

20100018825 Naval Research Lab., Washington, DC USA
Distributed Fiber Optic Sensing for Homeland Security
Kirkendall, C K; Bartolo, R; Salzano, J; Daley, K; Jan 2007; 3 pp.; In English
Report No.(s): AD-A518230; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518230

The need to protect our borders and critical infrastructure, such as pipelines, power distribution, and transportation, has grown in importance over the last few years. To address this need, fiber optic sensing technology developed in the Optical Sciences Division at NRL for antisubmarine warfare applications has recently been adapted to homeland security applications. Ground-based seismic sensing applications have significantly different requirements than traditional underwater acoustic applications. As a result, new optical interrogation and signal processing techniques are needed. Border and critical infrastructure sensor systems must be able to monitor long lengths (several km to several 10's of km) with reasonable spatial resolution (5 to 100 m), and have sufficient seismic sensitivity to detect targets of interest. We have developed and recently field-tested a fiber optic distributed seismic sensor system capable of meeting these requirements and report on some initial observations below.
DTIC
Detection; Detectors; Distributed Processing; Fiber Optics; Security; Signal Processing

20100018827 Naval Research Lab., Washington, DC USA
Optical Manipulation of Ultracold Atoms
Fatemi, F K; Bachkansky, M; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518234; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518234

It is well known that ultracold atoms (T 1 milliKelvin) are promising candidates for nextgeneration inertial sensors and magnetometers. An atom interferometer measures accelerations and rotations in much the same way as does a laser-based interferometer, except that the recorded interferograms are due to matter wave interference rather than optical interference. Large laboratory-based atom interferometers using thermal atom beams have demonstrated unparalleled performance, but the most promising path to making such technology practical is to use ultracold atoms: unlike room temperature atoms, cold atoms can be guided along controlled trajectories, analogous to fiber optics for light. The roles of matter and light are reversed - whereas material guides photons in fiber optics, photons guide atoms in atom optics. To realize high sensitivities with cold atoms, we must: (1) obtain a large flux of cold atoms and (2) guide atoms coherently in atom waveguides. Our group is working on these issues using optical techniques with cold atoms derived from a magneto-optical trap that contains roughly 108 rubidium atoms at a temperature of 10 muK and density of 10(11) atoms/cm(3).
DTIC
Atoms; Cryogenics; Interferometers; Low Temperature; Magneto-Optics

20100018838 Notre Dame Univ., IN USA
Ideal Channel Field Effect Transistors
Xing, Huili; Mar 2010; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-07-1-1134
Report No.(s): AD-A518256; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518256

Narrow bandgap semiconductors offer high carrier mobilities and low contact resistances while wide bandgap

semiconductors offer high breakdown voltages. A series of heterojunction transistors have been investigated and proved to be effective for improving both speed and power output in the past two decades. These devices include double heterostructure InP/InGaAs/InP bipolar transistors and composite channel InAlAs/InGaAs/InP/InAlAs high electron mobility transistors (HEMTs), which have taken the full advantage of the matched lattice constant (or pseudomorphic growth). However, for the most popular wide bandgap semiconductor GaN and SiC, the lattice mismatch between GaN and semiconductors with a reasonably small bandgap (including InGaN) is so large that pseudomorphic growth is very difficult. For instance, the critical thickness of InN on GaN is about one monolayer. To marry the advantages offered by both narrow bandgap and wide bandgap semiconductors, we explored direct wafer bonding for ideal channels made of extremely mismatched materials for field effect transistors. Toward this target, we have performed the following studies. This investigation demonstrated it is feasible to fabricate composite channel transistors, however, more experiments are necessary to understand the effects of the interface between the mismatch materials. A. Theoretically calculate scattering rates in composite channels. B. Theoretically calculate breakdown voltage in heterostructures containing wide bandgap material. C. Experimentally form mismatched GaAs/GaN heterostructures through direct wafer bonding and study the breakdown improvement compared with GaAs/GaAs homojunctions. D. Experimentally form InGaAs channel on mismatched GaN substrate and fabricate MISFETs on InGaAs/GaN.
DTIC
Field Effect Transistors; Gallium Arsenides; Gallium Nitrides

20100018897 Naval Research Lab., Washington, DC USA
Enhanced Electro-Optic Phase Shifts in Suspended Waveguides
Stievater, T H; Park, D; Rabinovich, W S; Pruessner, M W; Kanakaraju, S; Richardson, C J; Khurgin, J B; Jan 18, 2010; 9 pp.; In English
Report No.(s): AD-A518370; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We demonstrate enhanced electro-optic phase shifts in suspended InGaAs/InGaAsP quantum well waveguides compared to attached waveguides. The enhancement stems from an improved overlap between the optical mode and the multiple quantum well layers in thin waveguides when the semiconductor material beneath the waveguide is selectively etched. The measured voltage length product is 0.41 V-cm and the measured propagation loss is 2.3 +/- 0.7 dB/cm for the TE mode in the optical L-band.
DTIC
Electro-Optics; Phase Shift; Waveguides

20100018898 SEPA S.p.A. (Sistemi Elettronici per Automazione), Turin, Italy
Local Oscillator Contribution to Carrier-Phase Measurements in a GNSS Receiver
Detoma, E; Bonafede, L; Capetti, P; Nov 2009; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518373; No Copyright; Avail.: Defense Technical Information Center (DTIC)
When performing carrier-phase measurements, the measurement noise affecting the observations reflects two contributions, originating from the thermal noise of the RF signal received at the antenna and from the stability of the local oscillator over the integration time, since normally some form of phase-locked loop (PLL) is used for carrier recovery. The order of the PLL (and the bandwidth) determines the amount of the oscillator contribution to the measurement noise for a given oscillator frequency stability (or, since the integration time is generally less or equal to 1 s, to its phase noise). Therefore, it is important to understand the mechanism by which the local oscillator instability is transferred to the carrier-phase measurement noise and select a proper oscillator to minimize such a contribution. In the paper, we will address these issues, providing examples that guide the selection of the local oscillator. A practical example of implementation will be discussed, where a low-cost, high-stability OCXO has been disciplined to a Rb frequency standard to provide improved stability over the integration times of interest in order to minimize the noise for carrier-phase recovery.
DTIC
Measurement; Navigation Satellites; Oscillators; Receivers

20100018900 Naval Research Lab., Washington, DC USA
Detecting Low-Power RF Signals Using a Multimode Optoelectronic Oscillator and Integrated Optical Filter
Devgan, Preetpaul S; Pruessner, Marcel W; Urick, Vincent J; Williams, Keith J; Feb 1, 2010; 4 pp.; In English
Report No.(s): AD-A518380; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We have assembled and characterized a multimode optoelectronic oscillator with integrated optical filter for detecting

low-power radio-frequency (RF) signals. The system can selectively amplify RF signals from 1 to 6 GHz. The input signals can be as low as 83 dBm with a compression dynamic range of 72 dB. Using an integrated silicon optical filter facilitates channelization of the amplified RF signal from 1 to 3 GHz by reducing the gain for signals above 3 GHz. Future system improvements are discussed.
DTIC
Detection; Electro-Optics; Optical Filters; Oscillators; Radio Frequencies; Systems Integration

20100018902 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
High Power Microwave (HPM) and Ionizing Radiation Effects on CMOS Devices
Estep, Nicholas A; Mar 2010; 129 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518384; AFIT/GE/ENG/10-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Integrated circuits (ICs) are inherently complicated and made worse by increasing transistor quantity and density. This trend potentially enhances concomitant effects of high energy radiation and local or impressed electromagnetic interference (EMI). The reduced margin for signal error may counter any gain in radiation hardness from smaller device dimensions. Isolated EMI and ionizing radiation studies on circuits have been conducted extensively over the past 30 years. However, little focus has been placed on the combined effects. To investigate the effect of combined EMI and ionizing radiation, two complementary metal oxide semiconductor (CMOS) inverter technologies (CD4069 and SN74AUC1G04) were analyzed for their static performance in response to EMI and up to 146 kRad(tissue) gamma radiation. The combined EMI and gamma radiation environment, compared to the isolated effects, produced the most severe degradation in inverter performance for both device technologies.
DTIC
CMOS; Integrated Circuits; Ionizing Radiation; Microwaves; Radiation Effects

20100018918 Army Research Lab., Adelphi, MD USA
Viscous Hydrodynamic Model of Non-linear Plasma Oscillations in Two-Dimensional Gated Conduction Channels and Application to the Detection of Terahertz Signals
Rudin, Sergey; Apr 2010; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518431; ARL-TR-5157; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The conduction channel of a heterostructure High Electron Mobility Transistor can act as a plasma wave resonator for charge density oscillations at frequencies significantly higher than the transistor cut-off frequency in a short channel device. In the Dyakonov-Shur detector a short channel HEMT is used for the resonant tunable detection of electromagnetic radiation in the low terahertz range. Here I evaluated the resonant nonlinear response and obtained the temperature dependence of the quality factor of the plasma resonance. I find that in high mobility gated semiconductor conduction channels the quality of the resonance is limited by the temperature dependent viscosity of the electron fluid.
DTIC
High Electron Mobility Transistors; Hydrodynamics; Nonlinear Systems; Nonlinearity; Plasma Oscillations; Plasma Resonance; Signal Detection; Ultrahigh Frequencies; Viscosity

20100018919 Army Research Lab., Aberdeen Proving Ground, MD USA
Characterization Techniques Employed to Determine the Energy Release of Reactive Materials
Ritter, John J; Brant, Andrew L; Colburn, Joseph W; Homan, Barrie E; McNesby, Kevin L; Mar 2010; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518432; ARL-TR-5125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reactive materials show a promising future in an assortment of Army weapons systems due to their unique material characteristics. They have the potential to provide for enhanced lethality over their conventional munitions counterparts. However, those characteristics are not well defined, particularly the materials' fundamental energy release mechanisms. Through live fire experimental testing of an array of reactive materials consisting of an Al-Ni base, energy release characteristics can be understood on a more scientific level. This is accomplished through the incorporation of customized diagnostic techniques. Test samples of reactive material are fired via a powder gun into a steel-enclosed test chamber fitted with a polycarbonate window for witnessing the event. Raw data from the reaction event is recorded via high speed cameras and oscilloscopes. Analytical tools that are incorporated to characterize the event include pressure measurement gages, high speed imaging, pyrometry, spectroscopy, and flash x-ray. Through a systematic, scientific approach the vast amounts of data

collected using these diagnostic tools is then processed into practical information of the reactive material's energy release behavior.
DTIC
Aluminum; Characterization; Evaluation; Explosives; High Speed Cameras; Reactivity; System Effectiveness

20100018928 Naval Research Lab., Washington, DC USA
Unmanned Sea Surface Vehicle Electronic Warfare
Tremper, D; Heyer, J; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518455; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of tactical unmanned vehicles provides a means to accomplish a wide variety of combat missions without risk to operators' lives and without loss of expensive platforms. In addition, these vehicles offer an opportunity to rapidly field advanced warfighting capabilities at relatively low cost simply by developing payload systems that seamlessly integrate with the vehicle's onboard control network. With the emergence of open control system standards, such as the Joint Architecture for Unmanned Systems (JAUS), the ability to build so-called plug-and-play payloads is approaching reality. To exploit the opportunity of fielding advanced capabilities using unmanned platforms, the Tactical Electronic Warfare Division at NRL is developing an advanced electronic attack (EA) payload for surface ship defense that is suitable for unmanned vehicles like those planned for use with the Littoral Combat Ship. This development, sponsored by the Office of Naval Research, is designed to provide capabilities to counter late-generation sea surface surveillance and targeting radars found in maritime patrol aircraft and multirole fighters, and to provide the capability to attack anti-ship missiles during their initial target survey scans. Used singly, the unmanned vehicles provide a long-duration self-protection countermeasure system. Used in multi-vehicle constellations, the unmanned vehicles with EA payloads can be used to provide an area defense capability over large sectors.
DTIC
Control; Electronic Warfare; Ocean Surface; Regions; Simulation; Surface Vehicles

20100018929 Naval Research Lab., Washington, DC USA
Numerical Analysis of Electromagnetic Bandgap Structures
Chun, S T; Schechter, R S; Jan 2007; 3 pp.; In English
Report No.(s): AD-A518456; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electromagnetic bandgap (EBG) structures and negative index of refraction (NIR) meta-materials are periodic dielectric or metallic material structures that allow greater control over electromagnetic waves than has previously been possible. Man-made versions of these materials block the propagation of electromagnetic waves within particular frequency bands and allow propagation only in certain spatial directions (Fig. 1). They are scalable and operate over a wide range of frequencies. These qualities are very desirable for a variety of applications such as radar, communication devices, and sensors. Traditionally, the analysis of the electromagnetic properties of EBG materials relied heavily on the mathematics of infinite periodic structures, similar to that used to describe crystal diffraction. However, for real applications, the finite dimensions, lattice defects, and boundaries have to be included in the analysis to account for their impact on the bandgap characteristics. To accomplish this requires a direct numerical simulation of the finite EBG structure. We have used a Finite-Difference Time-Domain (FDTD) numerical code to design and characterize EBG structures and to analyze the electromagnetic performance of finite EBG structures at microwave frequencies. This code allows us to directly view the time evolution of the fields in these materials. The FDTD approach is useful for optimization of EBG parameters and can facilitate the design in many emerging applications.
DTIC
Electromagnetic Properties; Energy Gaps (Solid State); Finite Difference Theory; Finite Difference Time Domain Method; Numerical Analysis; Refractivity; Structural Analysis

20100018933 Allan's Time, Fountain Green, UT USA
The Impact of the HP 5071A on International Atomic Time. Appendix A
Allan, David W; Lepek, Alex; Cutler, Len; Giffard, Robin; Kusters, Jack; Dec 1995; 22 pp.; In English
Report No.(s): AD-A518478; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The international clock ensemble, which contributes to the generation of International Atomic Time (TAI and UTC), has improved dramatically over the last few years. The main change has been the introduction of a significant number of HP 5071A clocks. Of the 313 clocks contributing to TAI/UTC during 1994, 94 of these were HP 5071As. The environmental

insensitivity of the HP 5071A clocks is more than an order of magnitude better than that of previous contributing clocks. This environmental insensitivity translates to outstanding long-term stability - with a typical flicker floor of a few x10(-15). In addition, there are now several hydrogen masers with cavity tuning contributing to TAI/UTC. These not only have outstanding short-term stability, but comparatively low frequency drifts and excellent intermediate-term frequency stability. By analyzing the data available from the international ensemble, we have obtained two important results. First, the frequency stability obtainable with an optimum algorithm is about 10(-15) for both the intermediate and long-term regions. It could be as good in the short-term if time transfer measurement instabilities were reduced sufficiently. Second, with cooperation, this performance can be made available on an international basis in near real time. The recent enhancements in the contributing clocks are already providing a significant improvement in the accuracy with which UTC is made available to the world from several of the national timing centers, such as NIST and USNO.
DTIC
Atomic Clocks; Atoms; Real Time Operation; Sensitivity; Stability

20100018935 NTT Optical Network Systems Labs, Kanagawa, Japan
Accurate Time/Frequency Transfer Method Using Bi-Directional WDM Transmission
Imaoka, Atsushi; Kihara, Masami; Dec 1995; 14 pp.; In English
Report No.(s): AD-A518484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An accurate time transfer method is proposed using bi-directional wavelength division multiplexing (WDM) signal transmission along a single optical fiber. This method will be used in digital telecommunication networks and yield a time synchronization accuracy of better than 1 ns for long transmission lines over several tens of kilometers. The method can accurately measure the difference in delay between two wavelength signals caused by the chromatic dispersion of the fiber in conventional simple bi-directional dual-wavelength frequency transfer methods. We describe the characteristics of this difference in delay and then show that the accuracy of the delay measurement can be obtained below 0.1 ns by transmitting 156 Mb/s time reference signals of 1.31 micrometer and 1.55 micrometer along a 50 km fiber using the proposed method. The sub-nanosecond delay measurement using the simple bi-directional dual-wavelength transmission along a 100 km fiber with a wavelength spacing of 1 run in the 1.55 micrometer range is also shown.
DTIC
Accuracy; Fiber Optics; Frequencies; Transmission Lines; Wavelength Division Multiplexing

20100018953 Naval Research Lab., Washington, DC USA
Frequency Agile Target Array Controller
Lloyd, R L; Jan 2006; 3 pp.; In English
Report No.(s): AD-A518540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

NRL has developed and operates a large number of unique test facilities to conduct its research. One such facility, the Central Target Simulator (CTS), was designed to conduct real-time hardware-in-the-loop (HIL) simulations over the 8-18 GHz frequency range to evaluate and improve U.S. Navy electronic warfare (EW) systems, technologies, and techniques for countering the antiship missile (ASM) threat. The CTS uses actual radio frequency (RF) system hardware (e.g., missile seekers, EW equipment) and mathematically derived computer models to perform a realistic electromagnetic and physically dynamic simulation of the various elements of naval tactical engagements. Many of the more advanced missiles that now threaten U.S. Navy ships use radar seekers with frequency agile capabilities to acquire and track their targets. In addition to rapidly reducing (decorrelating) the effects of sea clutter, frequency agile radars are also better able to resist the effects of noise and interference. For instance, noise jamming (the intentional emission of RF energy at same transmit frequency) is a common method for interfering with radar operation. However, if the missile radar is frequency agile, effective jamming becomes more difficult to achieve because of the need to either spread RF energy over the full agility bandwidth or make an intelligent prediction of the next incoming transmitted frequency (which can be very difficult in a tactical scenario). Accordingly, NRL is actively pursuing the development of effective countermeasure technologies for such threat systems, and the CTS facility was recently upgraded to generate RF target returns that accurately follow the pulse-to-pulse frequency agile transmissions for such seekers.
DTIC
Antiship Missiles; Controllers; Frequencies; Frequency Hopping; Homing; Homing Devices; Jamming; Targets

20100018957 Naval Facilities Engineering Service Center, Port Hueneme, CA USA
Design of a Subsurface Moored Acoustic Array in Deep Water
Bartel, Warren; Greise, Mark; Jan 2007; 7 pp.; In English
Report No.(s): AD-A518553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The South TOTO Acoustic Measurement Facility (STAFAC) is currently under development at the Atlantic Undersea Test and Evaluation Center (AUTEC) to become the NAVY's subsurface moored East coast acoustic signature measurement facility. This paper discusses the mechanical design of the subsurface mooring system to support vertical acoustic arrays.
DTIC
Acoustic Measurement; Arrays; Deep Water; Mooring

20100018964 California Univ., Berkeley, CA USA
60 GHz Tapered Transmission Line Resonators
Marcu, Cristian; Niknejad, ALi; Sep 15, 2008; 46 pp.; In English
Contract(s)/Grant(s): DAAB07-02-1-L428; NSF-0403427
Report No.(s): AD-A518577; UCB/EECS-2008-117; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Millimeter-wave transceivers require a local reference frequency for upconversion from baseband to RF for transmission, or downconversion of received RF signals down to baseband. This reference can also be divided down to a lower frequency for use as the baseband clock signal. Voltage controlled oscillators (VCOs) can provide this local frequency reference either as free-running oscillators or locked to a stable reference using phase locked loops. Typically, VCOs which utilize a resonant tank achieve the best overall performance, and thus are very common in mm-wave applications. The design of CMOS mm-wave VCOs, however, involves a complex set of trade-offs between tuning range, phase noise, DC power consumption, and output power. In many cases, the most important of these metrics are tuning range and phase noise. The tuning range of the VCO must be large enough to cover the desired band of interest taking into account process, voltage, and temperature variations as well as modelling inaccuracies. Phase noise, on the other hand, contributes to the overall noise figure of the transceiver by causing downconversion of noise and any undesired signals located in frequencies adjacent to the desired signal. Both metrics, however, are strongly dependent on the type and quality factor of the resonant tank used, as shown by Leeson's well known equation for the phase noise of an oscillator.
DTIC
Microwave Transmission; Millimeter Waves; Resonators; Transmission Lines; Transmitter Receivers; Voltage Controlled Oscillators

20100019030 Technical Univ. of Munich, Muchen, Germany
Proceedings of IEEE International Conference on Nanotechnology (4th) held at the Technische Universitat Muenchen, Munich, Germany on 17-19 Aug 2004
Aug 2004; 130 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0094
Report No.(s): AD-A518746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The program of IEEE-Nano 2004 consists of 5 plenary talks, 15 invited presentations, approximately 110 contributed oral presentations and 90 contributed posters (distributed in 2 poster sessions). The Proceedings on CD-ROM contains all the contributed papers (oral and posters), and the Proceedings. Chairpersons and their collaborators are to be praised for such an outstanding achievement. In addition to the invited and contributed presentations, four tutorial short courses were offered on the first day. An exhibition was organized throughout the conference as well. A special panel session on the critical subject of how to teach nanotechnology was organized on Wednesday. A special symposium took place on Thursday afternoon, dedicated to the applications of Nanotechnology in Medicine. This interactive PDF contains schedule, author index of the conference, and sponsors.
DTIC
Conferences; Germany; Nanotechnology

20100019038 Parzen (Benjamin), San Diego, CA USA
Steady State Oscillator Analysis in the Immittance Domain
Parzen, Benjamin; Nov 1989; 11 pp.; In English
Report No.(s): AD-A518803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The theory of oscillator analysis in the immittance domain is presented. This theory enables the computer simulation of

the steady state oscillator. The simulation makes practical the calculation of the oscillator total steady state performance, including noise. Some oscillator applications of the PC program, BPT, created for the simulation, are listed.
DTIC
Electrical Impedance; Oscillators; Steady State

20100019047 Johns Hopkins Univ., Laurel, MD USA
Ultrastable Quartz Oscillator for Spacecraft
Norton, Jerry R; Nov 1989; 11 pp.; In English
Report No.(s): AD-A518816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new series of quartz oscillators that have excellent performance has been developed for use in spacecraft. Some oscillators using this design have demonstrated 24-hour aging rates of less than 1 x 10(-11), 100-s Allan variances of 7 x 10(-14), and a phase-noise floor of -158 dBc. Variations in resonator performance exceeding factors of 10 have been found during the evaluation of resonators using the same test oscillator; this finding indicates that oscillator performance is still dominated by the quartz resonator. SC cut resonators manufactured by different companies using a variety of mounting techniques and resonator enclosures have been used in this design. Some performance parameters are directly related to resonator type. The oscillators are designed to survive the rigorous environment of a rocket launch. They are projected to have a minimum useful life of 5 years in a space environment through the use of conservative design margins; high-reliability components, and a rugged mechanical package. A vibration isolation system is incorporated that attenuates the band of frequencies generated by currently available launch vehicles that could potentially damage the oscillator. The oscillators are compact and low weight and have low power consumption. A dual thermal insulating system using a unique Dewar flask design and a space blanket (alternate layers of a porous spacer and radiation-reflective aluminized Mylar) is used to isolate critical oscillator components from the thermal environment and to reduce power consumption. The design of the Dewar flask, which is made from titanium, requires no pinch-off tubes or other protrusions outside of the basic cylindrical envelope of the Dewar. A clearly defined frequency versus ambient pressure change was recognized during development of these oscillators.
DTIC
Oscillators; Quartz; Stability

20100019182 Army Research Lab., Adelphi, MD USA
Differential Amplifier Circuits Based on Carbon Nanotube Field Effect Transistors (CNTFETs)
Kilpatrick, Stephen; Chin, Matthew; Apr. 2010; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-to-SE-04/05
Report No.(s): AD-A517899; ARL-TR-5151; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517899

Carbon nanotube-based field effect transistors (CNTFETs) show potential in the area of integrated amperometric sensors due to their high sensitivity (ppm) to analytes, fast response times (seconds to minutes), and large surface area-to-volume ratios. This research demonstrates the design, fabrication, and testing of a CNTFET-based differential amplifier with the goal of achieving a nominal gain of 20 dB. Differential amplifiers possess the benefits of low noise, low distortion, and small signal amplification making them ideal for sensor applications. Building upon early results, methods for improving circuit design and device fabrication are explored.
DTIC
Amplifiers; Carbon Nanotubes; Circuits; Differential Amplifiers; Electrical Measurement; Field Effect Transistors

20100019186 Air Force Research Lab., Wright-Patterson AFB, OH USA; SRI International Corp., Menlo Park, CA, USA
Accurate Characterization of Free Carrier Refraction in InP (Postprint)
Gonzalez, Leonel P.; Guha, Shekhar; Krishnamurthy, Srinivasan; Proceedings of the SPIE Photonics West Conference; Feb. 2010; Volume 7582; 7 pp.; In English; SPIE Photonics West Conference, 23-28 Jan. 2010, San Francisco, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): Proj-4348
Report No.(s): AD-A517850; AFRL-RX-WP-TP-2010-4038; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517850

Using recently published results of intrinsic and free carrier nonlinear absorption coefficients in InP, nonlinear refraction was investigated at 1.064 micrometers using nanosecond duration lasers to characterize refraction from generated free carriers.

A phase retrieval algorithm was implemented to determine the amplitude and phase profiles of the incident beam. Accurate spatial and temporal profiles of the incident field were used to model nonlinear propagation through and beyond the sample. With the sample held fixed at focus and the incident energy increased, images of the transmitted beam a fixed distance away were recorded as a function of irradiance. Excellent agreement was observed between recorded beam images and those generated from the numerical model.
DTIC
Algorithms; Charge Carriers; Indium Phosphides; Infrared Radiation; Nonlinear Optics; Optical Materials; Radiance; Refraction

20100019193 Office of Inspector General, Arlington, VA USA
Al Qaim 33/11KV Electrical Mobile Substation Al Qaim, Iraq. Sustainment Assessment
Johnston, Angelina; O'Connor, Kevin; Sassaman, Shawn; Rawal, Yogin; Apr, 12, 2010; 29 pp.; In English
Report No.(s): AD-A518574; SIGIR-PA-09-191; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Electrical power is normally generated in power stations at voltages from 11 to 25 kilovolts (kV). In order to most efficiently transmit this power over long distances, it is stepped-up from 132 to 400kV. Power is then carried over long distances by the high voltage 132 to 400kV transmission lines. Substations step-down electrical power for eventual distribution to homes and business as shown below.
DTIC
Electric Potential; Electric Power Plants; International Relations; Iraq

20100019202 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Toward a Mobile Agent Relay Network
Kwak, Hyon H; Mar. 2010; 66 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518465; AFIT/GCS/ENG/10-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Although wireless communication provides connectivity where hardwired links are difficult or impractical, it is still hindered by the environmental conditions where the communicators reside. An alternative solution is to create a Mobile Agent Relay Network (MARN). Each autonomous node in the MARN decides where to move to maintain the network connectivity using only locally-available information from onboard sensors and communication with in-range neighbor nodes. This thesis takes the first steps toward realizing a MARN by providing mobile relay agents. Each model-based reflex agent is guided by a modified flocking behavior which considers only trustworthy neighbors and uses a Bayesian model to aggregate observations and shared reputation. The relay agents are able to build a network and maintain connectivity for their users. In this work, MARN agent algorithms are evaluated in a simulated unobstructed environment with stationary users. The system behavior is explored under both benign conditions and with varying numbers of misbehaving nodes.
DTIC
Algorithms; Autonomy; Detectors; Mathematical Models

20100019298 Institut de Recherche de l'Hydro-Quebec, Varennes, Quebec Canada
PTTI: Utilizations and Experimentations at Hydro-Quebec
Missout, Gilles; Dec 1996; 11 pp.; In English
Report No.(s): AD-A517877; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517877
Hydro-Quebec has a long history of PTTI applications. A brief review is presented on our phase angle measurement system and our special modified IRIG-B time code on microwave analog channels which are still in use. This is followed by a description of the use of GPS timing receivers for fault location on high-voltage lines and for synchronous measurement of the power grid. Then our recent experiments of time and frequency transmission on a 250-km overhead fiber optic ground wire is presented. This link uses one in-line optical amplifier. The absolute delay is characterized.
DTIC
Experimentation; Fiber Optics; Global Positioning System; Quebec; Transmission Lines

20100019351 Boston Coll., Chestnut Hill, MA USA
Innovative Techniques to Predict Atmospheric Effects on Sensor Performance
Dentamaro, Anthony V; Hohert, Patricia H; Oct 15, 2009; 20 pp.; In English
Contract(s)/Grant(s): FA8718-05-C-0085; Proj-1010
Report No.(s): AD-A518404; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Boston College Institute for Scientific Research is conducting innovative research in areas relating to development

and demonstration of new technologies to predict atmospheric effects on sensor performance for acquisition, mission planning and employment to the Air Force's current and next generation electro-optical (EO) systems. Emphasis includes space-, air-, and ground-based EO systems, laser systems including the Airborne Laser (ABL), surveillance and lidar and radar remote sensing technologies.
DTIC
Atmospheric Effects; Electro-Optics

20100019386 White Sands Missile Range, NM USA
The WSMR Timing System: Toward New Horizons
Gilbert, William A; Stimets, Bob; Dec 1995; 6 pp.; In English
Report No.(s): AD-A518489; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In 1991, White Sands Missile Range (WSMR) initiated a modernization program for its Range Timing System. The main focus of this modernization program was to develop a system that was highly accurate, easy to maintain, and portable. The logical decision at the time was to develop a system based solely on Global Positioning System (GPS) technology. Since that time, WSMR has changed its philosophy on how GPS would be utilized for the Timing System. This paper will describe WSMR's initial modernization plans for its Range Timing System and how certain events have led to a modification of these plans.
DTIC
Broadcasting; Global Positioning System; Horizon; Time Measurement; Timing Devices; Very High Frequencies

20100019389 National Renewable Energy Lab., Golden, CO USA
Twelve-Month Evaluation of UPS Diesel Hybrid Electric Delivery Vans
Lammert, M.; December 01, 2009; 38 pp.; In English
Contract(s)/Grant(s): DE-AC36-99-GO10337
Report No.(s): DE2010-969727; NREL/TP-540-44134; No Copyright; Avail.: National Technical Information Service (NTIS)
Results of an NREL study of a parallel hybrid electric-diesel propulsion system in United Parcel Service-operated delivery vans show that the hybrids had higher fuel economy than standard diesel vans.
NTIS
Energy Conservation; Hybrid Propulsion; Electric Propulsion

20100019397 Calabazas Creek Research, Inc., San Mateo, CA, USA
Improved Collectors for High Power Gyrotrons. (6/25/2006-3/24/2007)
Ives, R. L.; Singh, A.; Read, M.; Borchard, P.; Neilson, J.; May 20, 2009; 20 pp.; In English
Contract(s)/Grant(s): DE-FG02-06ER84441
Report No.(s): DE2010-952607; DOE/ER/84441-F; No Copyright; Avail.: National Technical Information Service (NTIS)
The program was tasked with determining feasibility of developing gyrotron collectors capable of reliable, long lifetime operation on 1.5 MW CW gyrotrons. Two approaches were explored. Task 2.2 investigated alternative designs to reduce the peak power densities and eliminate axial beam sweeping. These results confirmed that designs could be achieved with power densities compatible with continuous operation without beam sweeping. Therefore, the feasibility of this approach was clearly demonstrated. The second approach involved application of plasma coatings to copper collectors to provide increased strength for cyclic operation present in axial beam swept collectors. The thermal analyses indicated that cyclic lifetimes using pure tungsten coatings could be increased by approximately one order of magnitude over pure copper, though with decrease of lifetime for on/off operation. A plasma coating process was developed for plasma spraying of a tungsten - copper mixture to address the on/off operating performance.
NTIS
Accumulators; Cyclotron Resonance Devices; Thermal Analysis; Power Amplifiers

20100019630 Federal Univ. of Ceara, Fortaleza, Brazil
A New Dielectric Resonator Antenna Operating with Magneto-Dielectric Materials Based in Y3FE5-2xBIxBx Garnets
Sombra, Antonio S; Feb 28, 2010; 5 pp.; In English
Contract(s)/Grant(s): FA9550-08-1-0210
Report No.(s): AD-A518775; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518775
The main objective of this work was to study the dielectric properties of the GdIGxYIG1-x ferrite composite material at

radio frequency (RF) and microwave frequency bands were studied. These measurements were carried out in different sample geometries thick films and cylindrical ceramic bulk ferrite resonator. In the RF range, we observed that the material is rather stable because of its short changes as a function of temperature and frequency range. The temperature capacitance coefficient samples presented short positive values at the RF range In the study of the dielectric properties of the composites antenna geometry, with the same ferrite composite, a bulk cylindrical geometry was also investigated.
DTIC
Antennas; Dielectric Properties; Dielectrics; Garnets; Microwave Frequencies; Radio Frequencies; Resonators

20100019646 California Univ., Berkeley, CA USA
Data Compression for Maskless Lithography Systems: Architecture, Algorithms and Implementation
Dai, Vito; May 19, 2008; 169 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518852; UCB/EECS-2008-55; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518852

Future lithography systems must produce more dense microchips with smaller feature sizes, while maintaining throughput comparable to today's optical lithography systems. This places stringent data-handling requirements on the design of any maskless lithography system. Today's optical lithography systems transfer one layer of data from the mask to the entire wafer in about sixty seconds. To achieve a similar throughput for a direct-write maskless lithography system with a pixel size of 22 nm, data rates of about 12 Tb/s are required. In this thesis, we propose a datapath architecture for delivering such a data rate to a parallel array of writers. Our proposed system achieves this data rate contingent on two assumptions: consistent 10 to 1 compression of lithography data, and implementation of real-time hardware decoder, fabricated on a microchip together with a massively parallel array of lithography writers, capable of decoding 12 Tb/s of data. To address the compression efficiency problem, we explore a number of existing binary and gray-pixel lossless compression algorithms and apply them to a variety of microchip layers of typical circuits such as memory and control. The compression efficiency of various compression algorithms have been characterized on a variety of layouts sampled from many industry sources. Overall, we have found that compression efficiency varies significantly from design to design, from layer to layer, and even within parts of the same layer. The decoder for any chosen compression scheme must be replicated in hardware tens of thousands of times, to achieve the 12 Tb/s decoding rate. We explore the tradeoff between the compression ratio, and decoder buffer size for C4. We show that for a fixed buffer size, C4 achieves a significantly higher compression ratio than those of existing compression algorithms. We also present a detailed functional block diagram of the C4 decoding algorithm as a first step towards a hardware realization.
DTIC
Algorithms; Data Compression; Lithography; Very Large Scale Integration

20100019654 Texas A&M Univ., College Station, TX USA
Ultrashort Laser Pulse Propagation in Water
Kattawar, George W; Sokolov, Alexei V; Jan 2008; 13 pp.; In English
Contract(s)/Grant(s): N00014-08-1-0037
Report No.(s): AD-A518867; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518867

The major objectives of this proposal are twofold. The first objective is to perform both an experimental and theoretical study of the factors affecting the propagation distance behavior of ultrashort (femtosecond) laser pulses in water. This study will be conducted in the so-called linear regime which involves laser intensities that are below the threshold where nonlinear effects set in. A fundamental problem, which will be resolved by this research, is whether or not the temporal width and spacing of short pulses affects its absorption spectrum. If one simply knows the spectral composition of the input pulse and the absorption spectrum of the water, is this sufficient to predict the temporal evolution of the pulse? If such is not the case, then we will have to consider the way the system responds to pulse widths and pulse spacing which are short compared to vibrational relaxation times in water. The second phase of the research will be to explore the nonlinear regime where dramatic changes to the temporal, spatial, and spectral properties of the medium occur. The primary processes being selffocusing and self-phase modulation due to the Kerr effect (also called the quadratic electro-optic effect which was discovered by John Kerr in 1875). Self-focusing can lead to an enormous increase in the peak intensity where long filaments can occur and in some cases lead to supercontinuum generation or white light generation first discovered in 1970.
DTIC
Electro-Optics; Kerr Magnetooptical Effect; Pulsed Lasers; Water

20100019693 Florida Univ., Gainesville, FL USA

1.55 Micrometer Sub-Micron Finger, Interdigitated MSM Photodetector Arrays with Low Dark Current

Ren, Fan; Pearton, Stephen J; Feb 2, 2010; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-05-1-0373; Proj-622705

Report No.(s): AD-A518988; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518988

We have achieved following goals: * We have demonstrated the possibility to use a multiple wafer molecule beam epitaxy (MBE) system to grow 1.55 micrometer InGaAs based MSM detector structure on 4 inch GaAs substrate. * Design a mask to use flip-chip approach to fabricate MSM detector. A metal solder bump inkjet system was acquired. The system has the capability to deposit 25,000 metal bumps per second. A process development is under the way to develop the technique to use this advanced system for MSM detector bonding to replace the conventional wire bonding. * Transparent IZGO and IZO TFTs have been demonstrated, which can be integrated with MSM detectors.

DTIC

Dark Current; Fingers; Indium Gallium Arsenides; Low Currents; Molecular Beam Epitaxy; MSM (Semiconductors); Photometers

20100019697 Northwestern Univ., Evanston, IL USA

III-Nitride Based Optoelectronics

Razeghi, Manijeh; Jan 2010; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0497

Report No.(s): AD-A518997; 610-4741000-60013281-S449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518997

Ill-Nitride based optoelectronics support a variety of promising applications due to their tunable direct bandgap extending from deep ultraviolet towards green. We started by studying blue and green light emitting diode (LED) structures based on InGaN/GaN multiquantum wells (MQWs), grown on regular and lateral epitaxial overgrowth (LEO) GaN templates. We apply a unique pulsed epitaxy approach to achieve green LEDs. We also studied InGaN quantum dots for improved emission in the green spectrum. A novel hybrid green light-emitting diodes (LEDs) comprised of w-ZnO/ (InGaN/GaN) multi-quantum-wells/p-GaN were developed. The low temperature pulsed laser deposition (PLD) of the ZnO avoids the degradation typical when capping structures via metalorganic chemical vapor deposition. The results indicate that hybrid LED structures hold the prospects for developmenting green LEDs with superior performance. We also report on the current-voltage characteristic under forward biases obtained in low leakage, small size p-(In,Ga)N/GaN-n multiquantum well diodes. The detection of very low photon fluxes was reported under gated biasing in the 1 MV/cm range. We also reported on the fabrication and current-voltage characteristics of nanostructured p-i-n photodiodes based on GaN. Strong rectifying behavior was obtained; In contrast to GaN bulk p-i-n diodes, devices reproducibly show ideality factors lower than 2.

DTIC

Deposition; Electro-Optics; Indium Gallium Arsenides; Light Emitting Diodes; Nitrides; Organometallic Compounds; Photometers; Quantum Wells; Semiconductor Lasers; Vapor Deposition

20100019698 Georgia Tech Research Inst., Atlanta, GA USA

Persistent Currents in a Bose-Einstein Condensate

Raman, Chandra; Oct 2, 2009; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-05-1-0385

Report No.(s): AD-A519000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519000

This research program explored matter wave optics and rotating Bose-Einstein condensates (BECs). High sensitivity inertial sensors based on matter waves may benefit greatly from the coherence properties of condensates. We explored rotating BECs using Bragg spectroscopy and uncovered a new mechanism for measuring rotation. We realized a conical lens, or axicon, for matter waves by tailoring the expansion of a BEC using a far-detuned, intense, focused laser beam. We devised a new scheme for generating flexible, configurable optical traps for atoms using a two-axis scanning acousto-optic modulator, and applied this to realize a BEC in a toroidal potential. Finally, we discovered a mechanism for pumping vorticity into a Bose-Einstein condensate using time-varying magnetic fields, and therefore for the realization of quantum correlated states of large angular momentum.

DTIC

Acousto-Optics; Bose-Einstein Condensates; Interferometry; Laser Beams

20100019749 Pennsylvania Univ., Philadelphia, PA USA
Dielectric Sensing in E-Near-Zero Narrow Waveguide Channels
Alu, Andrea; Engheta, Nader; Jul 3, 2008; 7 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0622
Report No.(s): AD-A519123; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519123

We exploit here the dramatic field enhancement caused by energy squeezing and tunneling (i.e., supercoupling) in metamaterial-inspired ultranarrow waveguide channels with near-zero effective permittivity in order to sense small permittivity variations in a tiny object. The supercoupling effect is accurately modeled analytically and closed-form expressions are derived to describe the presence of defects or permittivity perturbations along the channel. Applications for tailoring its pass-band frequency and for high-Q sensing are proposed at microwave frequencies.
DTIC
Detection; Dielectric Properties; Dielectrics; Microwave Frequencies; Waveguides

20100019755 California Univ., Berkeley, CA USA
The Security of Machine Learning
Barreno, Marco; Nelson, Blaine A; Joseph, Anthony D; Tygar, Doug; Apr 24, 2008; 27 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0244; FA9550-07-1-0501
Report No.(s): AD-A519143; UCB/EECS-TR-2008-43; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519143

Machine learning has become a fundamental tool for computer security, since it can rapidly evolve to changing and complex situations. That adaptability is also a vulnerability: attackers can exploit machine learning systems. We present a taxonomy identifying and analyzing attacks against machine learning systems. We show how these classes influence the costs for the attacker and defender, and we give a formal structure defining their interaction. We use our framework to survey and analyze the literature of attacks against machine learning systems. We also illustrate our taxonomy by showing how it can guide attacks against SpamBayes, a popular statistical spam filter. Finally, we discuss how our taxonomy suggests new lines of defenses.
DTIC
Artificial Intelligence; Bandpass Filters; Computer Information Security; Machine Learning; Security

20100019880 Texas Univ., Austin, TX USA
Testing the Spectral Deconvolution Algorithm Tool (SDAT) with Xe Spectra
Biegalski, Steven R; Biegalski, Kendra M; Haas, Derek A; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-1-0017
Report No.(s): AD-A519365; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Spectral Deconvolution Analysis Tool (SDAT) software was developed to improve counting statistics and detection limits for nuclear explosion radionuclide measurements. SDAT utilizes spectral deconvolution spectroscopy techniques and can analyze both Beta-gamma coincidence spectra for radioxenon isotopes and high-resolution HPGe spectra from aerosol monitors. The SDAT tool has been integrated into a standalone graphical user interface (GUI). This GUI may import spectra, analyze the data for Xe concentrations, and graphically display the results. This tool has been tested with data generated via MCNPX models as well as real data.
DTIC
Algorithms; Radioactive Isotopes; Spectra; Spectrum Analysis; Xenon

20100019886 California Univ., San Diego, La Jolla, CA USA
An Improved Method of Back Azimuth Determination with a Multi-Arm OFIS
Walker, Kristoffer T; Zumberge, Mark; Berger, Jonathan; Hedlin, Michael A; Shearer, Peter M; Sep 2007; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-1-0020
Report No.(s): AD-A519375; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The detection of infrasound in the presence of wind is challenging. Increasing wind speeds lead to higher noise floors. While the exact nature of the noise is still a subject of investigation, several technologies and array configurations have been

developed to maximize the signal to noise ratio and lower the detection threshold. Optical fiber infrasound sensors (OFIS) are long compliant tubes wrapped with two optical fibers that integrate pressure change along the length of the tube with laser interferometery. Spatially incoherent wind noise is naturally attenuated relative to spatially coherent infrasound. Because the signal pressure variation is integrated along the length of the tube, the instrument response is a function of the orientation of the OFIS arms relative to the orientation of the wavefront. We show with theory and real infrasound data recorded at Pinon Flat Observatory in southern California that this spectral property can be exploited with multiple OFIS arms in different ways to determine the phase velocity of infrasound signals. Based on these findings and unpublished results, we propose two OFIS configurations as alternatives to rosette pipe array infrasound stations.
DTIC
Azimuth; Fiber Optics; Infrasonic Frequencies; Interferometry; Laser Interferometry; Optical Fibers; Transmission Lines; Wave Fronts

20100019887 California Univ., San Diego, La Jolla, CA USA
OFIS Experiments at Camp Elliott: Paving the Way to Infrasonic Radar and a Portable Infrasonic Sensor Calibrator
Walker, Kristoffer T; Zumberge, Mark; Dzieciuch, Matthew A; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-06-1-0002
Report No.(s): AD-A519376; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Optical fiber infrasound sensors (OFIS) are long compliant tubes wrapped with two optical fibers that integrate pressure variation along the length of the tubes via laser interferometry at the speed of light. We have previously shown that several OFIS arms can resolve the back azimuth and elevation angle of infrasound signals due to the spectral fingerprint of the instrument response in the recorded signal and the time separation provided by separating the centers of each OFIS arm. In this paper, we present the recent results of calibration, coherence, wind-noise reduction, and fine-tuning experiments that we accomplished in route to completing our grant objectives. Specifically, we show that the sensitivity of the OFIS is temperature dependent, and develop a real-time calibration system that allows us to compensate for this variation. We also show that M-sequences transmitted via subwoofers can be used as portable calibration tools in the low-frequency audible range and can test wind noise reduction technologies for some sensors. Comparison of a 60-m OFIS with a B&K microphone at a signal frequency of 50 Hz for a source tilde 300 m away shows that the OFIS reduces wind and other types of undesirable noise by 12 dB over the B&K microphone with an attached sponge wind filter. We also present the layout of a six-arm OFIS array at Camp Elliott (CEL) in north San Diego county where our investigations are continuing. This array has an aperture of 150 m, and is collocated with a digital video camera that will provide confirmation of the back azimuth and elevation angle of aircraft infrasound signals that are tracked by a passive infrasonic radar system.
DTIC
Calibrating; Data Recording; Digital Systems; Fiber Optics; Infrasonic Frequencies; Interferometry; Laser Interferometry; Optical Fibers; Transmission Lines; Wind (Meteorology)

20100019890 Michigan Univ., Ann Arbor, MI USA
Relativistic Magnetron Priming Experiments and Theory
Gilgenbach, R M; Lau, Y Y; Vidmar, R; Mar 29, 2010; 20 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0087
Report No.(s): AD-A519384; 10-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Experiments and simulations were performed on magnetic priming to improve performance of relativistic magnetrons. Magnetic priming comprises N/2 azimuthal variations of magnetic field in N-cavity magnetrons. Experiments were performed on the 6-cavity, UM-L-3 magnetron at MELBA-C parameters of-300 kV, 1-5 kA and 300-500 ns. For unbalanced loads, magnetron performance was greatly improved by magnetic priming over baseline (uniform-B), including: a) reduction of start-oscillation time to 57% of baseline, b) Doubling of peak microwave power, and c) 20% increase in pulselength. Smaller improvements were observed for the balanced load case. Microwave window breakdown was eliminated by a redesign, tripling both the microwave power and pulselength. Theory included: 1. Discovery of unexpected effects of ions in magnetically insulated crossed-field gap. 2) Buneman-Hartree condition was critically re-examined in a cylindrical relativistic magnetron.
DTIC
Magnetic Fields; Magnetrons

20100019894 Naval Surface Warfare Center, Dahlgren, VA USA

LeadingEdge: Challenges and Solutions for the 21st Century, Electromagnetic Environmental Effects. Volume 7, Issue 1, 2009

Shannon, James J; Jan 2009; 137 pp.; In English

Report No.(s): AD-A519396; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Communications, electronics, and sensor systems aboard U.S. naval ships and submarines must operate effectively in order to support the execution of military missions and operations. Whether operating alone or with coalition forces, the Navy must be prepared to execute its missions anywhere in the world and under any condition. We must also be prepared to operate effectively throughout the entire frequency spectrum. As such, the Navy's systems must operate and interoperate safely and effectively without interfering with or degrading the system performance of other systems aboard ship. It is also necessary that U.S. systems do not impact, or be impacted by, other coalition or adversary systems operating in the same electromagnetic environment. This issue of The Leading Edge, sponsored by the NAVSEA Warfare Centers, is dedicated to the critically important area of electromagnetic environmental effects, otherwise referred to as E3. It is an area that touches all naval operations -- afloat and ashore, and all spectrums of conflict. So, whether the Navy's actions involve combating traditional adversaries, countering terrorism, thwarting pirates, responding to natural disasters, or supporting humanitarian operations, the Navy's systems must operate effectively and reliably in the electromagnetic environment in order for its missions to succeed. Ensuring that the Navy's missions succeed underlies one of the NAVSEA Warfare Centers' most important roles.

DTIC

Electromagnetic Properties; Environment Effects; Military Operations

20100019897 Akron Univ., Akron, OH USA

Strain and Polarization Studies of InGaN for Optoelectronic, Electronic, and Photovoltaic Applications

Pan, Ernie; Albrecht, John; Dec 14, 2009; 199 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0317

Report No.(s): AD-A519405; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This final report summarizes the investigation conducted at the University of Akron by Prof. Ernie Pan's group in close collaboration with AFRL Sensors Directorate (Dr. John Albrecht AFRL/IRDX). Through this work, we have co-developed electro-mechanical simulations that take into account material polarization and piezoelectric properties that cannot be suppressed in many group III-V semiconductor nanostructures. This work addresses key physics issues in these polarized semiconductors and also provides laboratory researchers with access to design and analysis specifics that are not accessible by or do not exist in the limited physical models available in commercial semiconductor modeling software. The specifics of these models and related publications are provided in the chapters of the report. Another important contribution is on the magnetoelectric (ME) effect of multiferroic composites. We found that while any imperfect interface would reduce the ME effect in multiferroic composites, suitably designed graded composites can substantially enhance the ME effect.

DTIC

Boundary Integral Method; Composite Materials; Integral Equations; Nanostructures (Devices); Quantum Dots; Semiconductors (Materials)

20100019900 National Inst. of Standards and Technology, Boulder, CO USA

RFSQUID-Mediated Coherent Tunable Coupling Between a Superconducting Phase Qubit and a Lumped Element Resonator

Allman, Michael S; Altomare, F; Whittaker, J D; Cicak, K; Li, D; Sirois, A; Strong, J; Teufel, J D; Simmonds, R W; Feb 2, 2010; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0384

Report No.(s): AD-A519412; ARO-CIN:509280001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We demonstrate coherent tunable coupling between a superconducting phase qubit and a lumped element resonator. The coupling strength is mediated by a flux-biased RF SQUID operated in the nonhysteretic regime. By tuning the applied flux bias to the RF SQUID we change the effective mutual inductance, and thus the coupling energy, between the phase qubit and resonator. We verify the modulation of coupling strength from 0 to 100 MHz by observing modulation in the size of the splitting in the phase qubit's spectroscopy, as well as coherently by observing modulation in the vacuum Rabi oscillation frequency when on resonance. The measured spectroscopic splittings and vacuum Rabi oscillations agree well with theoretical predictions.

DTIC

Couplings; Resonators; Superconductivity

20100019914 Cornell Univ., Ithaca, NY USA

Growth of Thin Hetero-Epitaxial Layers of Graphite and Diamond on SIC for Carbon Based Electronics

Spencer, M G; Feb 2010; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-07-1-0332

Report No.(s): AD-A519446; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the course of this work atmospheric and UHV techniques were developed for the production of few layer graphene on the Si and C face of SiC. In was found that control of the rate of Si loss (as determined by the surface temperature gradient) was necessary to produce high quality films on both the Si and C face. The quality of these films was confirmed by AFM, Hall, Raman, and high speed laser techniques. In particular the disorder ratio as determined by Raman analysis was less than .02. The results of the growth investigations were applied to the development of a commercial graphene materials growth reactor. One monolayer self supporting films of graphene we produced by a novel technique which under etched the SiC below the formed graphene. These self supporting layers have been used in fundamental studies on the mechanical and transport properties of graphene. Using the material developed in the project graphene gas sensors have been demonstrated.

DTIC

Carbon; Diamond Films; Diamonds; Epitaxy; Graphite; Silicon Carbides; Thin Films

20100019940 Beijing Inst. of Radio Metrology and Measurements, China

The Measurement System of Pulse Modulated Carrier Frequency Stability and Timing Jitter

Li, Cheng-Fu; Dec 1991; 11 pp.; In English

Report No.(s): AD-A519501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the definition of pulse modulated carrier frequency stability and timing jitter as well as the configuration and synchronous acquisition measurement method of its measurement system. Frequency stability of pulse modulated carrier is measured with discrimination technique. The pulse modulated carrier under test is mixed with a reference frequency synthesizer. A delay line is used to convert the frequency fluctuation mixed IF signal to the voltage fluctuation. The system has the capability to make the phase noise measurement of two port devices on pulsed carrier using phase bridge. The noise voltage mentioned above is applied to the data acquisition and processing unit by pc to realize stability measurement. The data acquisition is in the form of pulse synchronization so that the measurement system accuracy is increased. The pulse width is more than 0.3 microseconds. The phase fluctuation variance o is less than 0.017, The time interval measuring system with high resolution is used to make interpulse timing and pulse width jitters automatic measurement. The pulse width is less than 0.2 ns. The resolutiun is 0.1 ns. The system is successfully applied to radar measurement.

DTIC

Carrier Frequencies; Frequency Stability; Vibration

20100019963 Fleet Electronic Warfare Center, Norfolk, VA USA

Spectrum Management and Electromagnetic Environmental Effects (E3) Business Process

Tabor, Chuck; May 6, 2010; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519549; No Copyright; Avail.: Defense Technical Information Center (DTIC)

OPNAVINST 2400.20F: Electromagnetic Environmental Effects (E3) and Spectrum Supportability Policy and Procedures (Jul 2007). (1) PURPOSE: To establish Navy policy and procedures and assign responsibilities for Electromagnetic Environmental Effects (E3) and Spectrum Supportability (SS). (3) Scope and Applicability: (a) This instruction establishes Navy policy and assigns responsibilities for achieving SS and ensuring reliable, safe, and mission capable operations of all Electrical and Communications-Electronics (C-E) equipment, systems and subsystems, devices, ordnance, and fuels within their intended operational Electromagnetic Environment (EME), including effects on personnel.

DTIC

Commerce; Environment Effects; Radiation Effects; Spectra

20100019980 Naval Surface Warfare Center, Dahlgren, VA USA

Afloat Electromagnetic Spectrum Operations Program (AESOP) Spectrum Management Challenges for the 21st Century

Neel, Margaret; Mar 3, 2010; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519589; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AESOP is the US Navy tool for Strike Group Radar and Communications Planning for coordinating spectrum interoperability in afloat operations worldwide. * AESOP uses previously allocated frequencies to generate optimal Radar

Plans and OPTASK COMMs that adhere to laws and numbered fleets' emission policies. * AESOP integrates and de-conflicts the spectrum requirements of all acquired systems in the global operational electromagnetic environment (EME).
DTIC
Electromagnetic Spectra; Project Management; Spectra; Spectrum Analysis

20100020014 California Univ., San Diego, La Jolla, CA USA
A New Design of Differential Space-Time Block Code Allowing Symbol-Wise Decoding
Chang, Yu; Hua, Yingbo; Sadler, Brian M; Sep 2007; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0224
Report No.(s): AD-A519677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For four (or more) transmitters, a new design of differential space-time block code allowing symbol-wise decoding is presented in this letter. The new design not only has the minimum (symbol-wise) decoding complexity as that by Yuen, Guan and Tjhung (YGT) but also yields a lower error rate. While the YGT code uses a specifically designed symbol constellation, the new code uses a conventional QAM with a rotation. At a high data rate such as 3bps/Hz, the new design with symbol-wise decoding complexity can even yield a lower error rate than the code by Zhu and Jafarkhani that has the pair-wise decoding complexity.
DTIC
Decoding; Symbols

20100020024 Sand 9, Inc., Cambridge, MA USA
TCMO(TM): A Versatile MEMS Oscillator Timing Platform
Schoepf, K J; Rebel, R; Chen, D M; Zolfagharkhani, G; Gaidarzhy, A; Kuypers, J H; Crowley, M; Mohanty, P; Nov 2009; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519709; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper demonstrates the first MEMS oscillator with a performance comparable to a temperature-compensated crystal oscillator (TCXO) in frequency accuracy, temperature stability, and phase noise. The presented temperature-compensated MEMS oscillator (TCMO[Trade Mark]) achieves -116 dBc/Hz phase noise at 1 kHz offset from the 123.9 MHz carrier, relating to a phase noise value of -135.6 dBc/Hz at 1 kHz offset at 13 MHz. The temperature drift of the MEMS oscillator is within plus or minus 2.5 ppm over the entire operating temperature range from -40 degrees C to +85 degrees C. The TCMO[TM] uses a unique circuit architecture for an analog temperature compensation so that the output frequency does not suffer from frequency or phase discontinuities.
DTIC
Microelectromechanical Systems; Oscillations; Oscillators

20100020181 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Longitudinal Proximity Effects in Superconducting Transition-Edge Sensors
Sadleir, John E.; Smith, Stephen J.; Bandler, Simon R.; Chervenak, James A.; Clem, John R.; January 11, 2010; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DE-AC02-07CH11358; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020181

We have found experimentally that the critical current of a square thin-film superconducting transition-edge sensor (TES) depends exponentially upon the side length L and the square root of the temperature T, a behavior that has a natural theoretical explanation in terms of longitudinal proximity effects if the TES is regarded as a weak link between superconducting leads. As a consequence, the effective transition temperature T(sub c) of the TES is current-dependent and at fixed current scales as 1/L(sup 2). We also have found that the critical current can show clear Fraunhofer-like oscillations in an applied magnetic field, similar to those found in Josephson junctions. We have observed the longitudinal proximity effect in these devices over extraordinarily long lengths up to 290 micrometers, 1450 times the mean-free path.
Author
Superconducting Films; Superconductivity; Thin Films; Sensors; Longitude; Electrical Resistivity

20100020311 California Univ., Berkeley, CA USA
Field-Programmable Gate Array (FPGA) Emulation for Computer Architecture
Wawrzynek, J.; Asanovic, K.; August 2009; 38 pp.; In English
Contract(s)/Grant(s): FA8650-09-C-7907; Proj-ARPR; 62303E
Report No.(s): AD-A519578; AFRL-RY-WP-TR-2009-1281; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The scope of this program is to explore the use of FPGA-based systems for different applications including architecture-level FPGA emulation in support of future multiprocessor architecture research. We evaluate FPGA emulation approaches against conventional simulation techniques, and determine the missing capabilities that will require further development. In particular, we compare the various possible modeling approaches and evaluated their capabilities in terms of model fidelity, emulator performance, and design effort. We also investigate techniques to incorporate energy, power, and thermal models into architecture-level FPGA emulation frameworks.
DTIC
Architecture (Computers); Field-Programmable Gate Arrays

20100020315 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ USA
Radio Frequency (RF) Propagation Along Single Cylindrical Conductors
Friedman, D. Clint; Goldman, Harris; April 2010; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519391; ARWSE-TR-09009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report examines the transmission of 10 GHZ radio frequency (RP) waves among single cylindrical conductors. Intent is to determine attenuation as a function of distance and conductivity in order to enhance understanding of phenomena related to attachment and transmission of RF to a laser generated plasma filament(s). Attenuation is shown to be highly dependent on conductivity as well as diameter of conductor in some cases providing significant gain over free space propagation. This increase in gain demonstrates promise of a single cylindrical conductor as a transmission mechanism. Data is shown to be relatively consistent with Finite Difference Time Domain modeling for the case of a single cylindrical conductor and open ended waveguide.
DTIC
Conductors; Cylindrical Bodies; Electric Conductors; Electromagnetic Wave Transmission; Radio Frequencies

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FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20100018526 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Finite-Volume Method for Convection Problems with Embedded Moving Boundaries
Hassen, Yunus J.; Koren, Barry; January 2009; 12 pp.; In English
Report No.(s): PB2010-107589; MAS-E0901; Copyright; Avail.: National Technical Information Service (NTIS)

An accurate method, using a novel immersed-boundary approach, is presented for numerically solving linear, scalar convection problems. Moving interior boundary conditions are embedded in the fixed-grid fluxes in the direct neighborhood of the moving boundaries. Tailor-made limiters are derived such that the resulting scheme is monotone. The results obtained are very accurate, without requiring much computational overhead. It is anticipated that the method can readily be extended to real fluid-flow equations.
NTIS
Convection; Embedding; Finite Volume Method

20100018943 Naval Research Lab., Bay Saint Louis, MS USA
Advanced Surge and Inundation Modeling: A Case Study from Hurricane Katrina
Blain, C A; Massey, T C; Dykes, J D; Posey, P G; Jan 2007; 10 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The storm surge and inundation from Hurricane Katrina that devastated Gulf Coast communities on August 29, 2005, presented an opportunity to evaluate and advance coastal ocean modeling capabilities at NRL and within the Navy. A highly realistic simulation of Katrina's storm surge and inland inundation was developed using the ADvanced CIRCulation

(ADCIRC) model. The finite-element basis of ADCIRC is advantageous in its utilization of unstructured triangular grids. The Katrina grid contains 375,479 computational points and 730,431 triangular elements with 225 m spatial resolution in coastal and inland areas, resulting in the largest Navy application of unstructured grid models to date. Comparison between the model-computed high water values at measured high water mark locations along the Gulf coast indicate very good agreement between observed and predicted water levels with average errors of just over one foot. NRL recently transitioned the ADCIRC model to fleet operations for coastal predictions and remains an active ADCIRC development partner.
DTIC
Coasts; Hurricanes; Ocean Models; Storm Surges; Surges

20100019160 NASA Langley Research Center, Hampton, VA, USA
The Effects of Temperature, Humidity and Aircraft Fluid Exposure on T800H/3900-2 Composites Bonded with AF-555M Adhesive
Miner, Gilda A.; Hou, Tan-Hung; Lowther, Sharon E.; Thibeault, Sheila A.; Connell, John W.; Blasini, Sheila Roman; May 10, 2010; 18 pp.; In English; 2010 Aircraft Airworthiness & Sustainment Conference, 10-13 May 2010, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 698259.02.07.07.04.04
Report No.(s): NF1676L-10362; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019160

Fiber reinforced resin matrix composites and structural adhesives have found increased usage on commercial and military aircraft in recent years. Due to the lack of service history of these relatively new material systems, their long-term aging performance has not been well established. In this study, single lap shear specimens (SLS) were fabricated by secondary bonding of Scotch-Weld(TradeMark) AF-555M between pre-cured adherends comprised of T800H/3900-2 uni-directional laminates. The adherends were co-cured with wet peel-ply for surface preparation. Each bond-line of the SLS specimen was measured to determine thickness and inspected visually using an optical microscope for voids. A three-year environmental aging plan for the SLS specimens at 82 C (180 F) and 85% relative humidity was initiated. SLS strengths were measured for both controls and aged specimens at room temperature and 82 C. The effect of this exposure on lap shear strength and failure modes to date is reported. In addition, the effects of water, saline water, deicing fluid, JP-5 jet fuel and hydraulic fluid on both the composite material and the adhesive bonds were investigated. The up to date results on the effects of these exposures will be discussed.
Author
Composite Materials; Fiber Composites; Adhesive Bonding; Laminates; Resin Matrix Composites; Temperature Effects; Long Term Effects; Hydraulic Fluids; Failure Modes; Aging (Materials)

20100019162 NASA Langley Research Center, Hampton, VA, USA
Validations of Coupled CSD/CFD and Particle Vortex Transport Method for Rotorcraft Applications: Hover, Transition, and High Speed Flights
Anusonti-Inthra, Phuriwat; May 11, 2010; 11 pp.; In English; AHS International 66th Annual Forum and Technology Display, 11-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS1-2117; NNL07AA31C; NNL07AA32C; WBS 877868.02.07.07.04.01
Report No.(s): NF1676L-10441; Copyright; Avail.: Other Sources

This paper presents validations of a novel rotorcraft analysis that coupled Computational Fluid Dynamics (CFD), Computational Structural Dynamics (CSD), and Particle Vortex Transport Method (PVTM) methodologies. The CSD with associated vehicle trim analysis is used to calculate blade deformations and trim parameters. The near body CFD analysis is employed to provide detailed near body flow field information which is used to obtain high-fidelity blade aerodynamic loadings. The far field wake dominated region is simulated using the PVTM analysis which provides accurate prediction of the evolution of the rotor wake released from the near body CFD domains. A loose coupling methodology between the CSD and CFD/PVTM modules are used with appropriate information exchange amongst the CSD/CFD/PVTM modules. The coupled CSD/CFD/PVTM methodology is used to simulate various rotorcraft flight conditions (i.e. hover, transition, and high speed flights), and the results are compared with several sets of experimental data. For the hover condition, the results are compared with hover data for the HART II rotor tested at DLR Institute of Flight Systems, Germany. For the forward flight conditions, the results are validated with the UH-60A flight test data.
Author
Computational Fluid Dynamics; Rotary Wing Aircraft; Hovering; Flight Tests; Horizontal Flight; Near Fields

20100019370 Battelle Pacific Northwest Labs., Richland, WA USA

Characterization of Phoswich Well Detectors for Radioxenon Monitoring

Hennig, Wolfgany; Tan, Hui; Warburton, William K.; Fallu-Labruyere, Anthony; Sabourov, Konstantin; McIntyre, Justin I.; Cooper, Matthew W.; Gleyzer, Anshel; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; Sep. 2007, pp. 757-763; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FG02-04ER841210

Report No.(s): AD-A518201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518201

Devices to measure the amount of radioactive xenon in the atmosphere have been installed in several locations around the world as part of the International Monitoring System to detect nuclear weapons testing. These devices extract small samples of xenon from large volumes of air and look for characteristic radioxenon isotopes emitting beta and gamma radiation in coincidence. To detect these coincidences, they currently employ a complex system of separate beta and gamma detectors which is very sensitive, but which requires careful calibration and gain matching of several detectors and photomultiplier tubes to achieve desired detection limits. An alternative to separate beta and gamma detectors is the use of a single phoswich detector in which beta-gamma coincidences are detected by pulse shape analysis. The phoswich detector consists of a plastic scintillator (absorbing betas) optically coupled to a CsI(Tl) scintillator (absorbing gammas) and thus requires only a single photomultiplier tube and electronics readout channel, greatly simplifying setup and calibration. In this paper, we present the results from an experimental evaluation of two phoswich well detector prototypes, including energy resolution, 2-D beta/gamma energy histograms from a variety of test sources, and background count rates. From these measurements, we derive detector properties such as coincidence detection efficiency, background rejection and the ability to separate beta only, gamma only, and coincidence events. We will further discuss setup and calibration procedures and compare them to those for existing detector systems.

DTIC

Detectors; Nuclear Explosions; Radioactive Isotopes

20100019371 Battelle Pacific Northwest Labs., Richland, WA USA

Automated QA/QC Check for Beta-Gamma Coincidence Detector

Cooper, Matthew W.; Hayes, James C.; Heimbigner, Tom R.; Hubbard, Charles W.; McIntyre, Justin L.; Ripplinger, Michael D.; Schrom, Brian T.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; Sep. 2007, pp. 739-746; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-AC05-RLO1830/PL07-DAS-NEM02

Report No.(s): AD-A518200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518200

The Automated Radioxenon Sampler/Analyzer (ARSA) (Hayes 1999), built by Pacific Northwest National Laboratory (PNNL), can collect and detect several radioxenon isotopes. The ARSA is very sensitive to (133)Xe, (131m)Xe, (133m)Xe, and (135)Xe due to the compact high-efficiency beta-gamma coincidence detector it uses. As detection technology improves and more emphasis is placed on system automation, QA/QC checks become of increasing importance. By automating the QA/QC checks, the reliability of the data sets is ensured without the necessity of monitoring. Often, the automated QA/QC checks will be done on site, where radio-xenon gas is not readily available so it is important to be able to use sealed point sources as an alternative. Immediately after the initial calibration of the detector, a (137)Cs source, which has a 661.7-keV gamma-ray, is used to generate both gamma and beta spectra. The two spectra are saved to file, are called the template spectrum, and will be used as the template to perform on site QA/QC checks. The QA/QC check will automatically find the start and end points of the beta spectrum and compare them with those from the template spectrum. A similar method is used for the gamma spectrum; however, in a gamma spectrum the 661.7-keV peak can be used for the high energy end. If the points do not match, a gain and offset can be calculated to make the QA/QC spectra match the template spectra. A second and more advanced method is to take a beta-gamma coincidence spectrum for the template spectrum. A comparison of the QA/QC beta-gamma coincidence spectrum to the template spectrum will be used to determine what if any adjustments need to be made on the gain and offset. A detailed discussion of the QA/QC checks will be included in the paper.

DTIC

Detectors; Nuclear Explosions; Quality Control; Radioactive Isotopes; Xenon

20100019441 NASA Langley Research Center, Hampton, VA, USA
Calibration Designs for Non-Monolithic Wind Tunnel Force Balances
Johnson, Thomas H.; Parker, Peter A.; Landman, Drew; May 10, 2010; 16 pp.; In English; 7th International Symposium on Strain-Gauge Balances, 10-13 May 2010, Williamsburg, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 736466.01.08.07.01.02
Report No.(s): NF1676L-10686; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019441

This research paper investigates current experimental designs and regression models for calibrating internal wind tunnel force balances of non-monolithic design. Such calibration methods are necessary for this class of balance because it has an electrical response that is dependent upon the sign of the applied forces and moments. This dependency gives rise to discontinuities in the response surfaces that are not easily modeled using traditional response surface methodologies. An analysis of current recommended calibration models is shown to lead to correlated response model terms. Alternative modeling methods are explored which feature orthogonal or near-orthogonal terms.
Author
Calibrating; Wind Tunnel Apparatus; Wind Tunnel Models; Regression Analysis; Experiment Design; Aerodynamic Balance

20100019467 NASA Glenn Research Center, Cleveland, OH, USA
Comparisons of Flutter Analyses for an Experimental Fan
Bakhle, Milind A.; Reddy, T. S. R.; Stefko, George L.; April 2010; 16 pp.; In English; 19th International Society for Air Breathing Engines Conference (ISABE 2009), 7-11 Sep. 2009, Montreal, Quebec, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581 .02.08.03.29 03; WBS 984754 .02.07.03.16.05
Report No.(s): NASA/TM-2010-216221; ISABE-2009-1189; E-17202; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019467

Two propulsion aeroelasticity codes were used to model the aeroelastic characteristics of an experimental forward-swept fan that encountered flutter during wind tunnel testing. Both of these three-dimensional codes model the unsteady flowfield due to blade vibrations using the Navier-Stokes equations. In the first approach, the unsteady flow equations are solved using an implicit time-marching approach. In the second approach, the unsteady flow equations are converted to a harmonic balance form and solved using a pseudo-time marching method. This paper describes the flutter calculations and compares the results to experimental measurements.
Author
Flutter Analysis; Wind Tunnel Tests; Aeroelasticity; Aircraft Engines; Harmonic Control; Turbomachinery; Fan Blades

20100019476 Pennsylvania State Univ., University Park, PA, USA
Hypersonic Turbulent Boundary-Layer and Free Sheer Database Datasets
[Data Set]
Settles, Gary S.; Dodson, Lori J.; April 1993; In English; See also 19950005579; CD-ROM contains 11 files in .dat format
Contract(s)/Grant(s): NAG2-565; RTOP 763-21-31
Report No.(s): NASA-CR-177610; A-93065; Copyright; Avail.: CASI: C01, CD-ROM

A critical assessment and compilation of data are presented on attached hypersonic turbulent boundary layers in pressure gradients and compressible turbulent mixing layers. Extensive searches were conducted to identify candidate experiments, which were subjected to a rigorous set of acceptance criteria. Accepted datasets are both tabulated and provided in machine-readable form. The purpose of this database effort is to make existing high quality data available in detailed form for the turbulence-modeling and computational fluid dynamics communities. While significant recent data were found on the subject of compressible turbulent mixing, the available boundary-layer/pressure-gradient experiments are all older ones of which no acceptable data were found at hypersonic Mach numbers.
Author
Data Bases; Hypersonic Boundary Layer; Hypersonics; Shear Layers; Turbulence; Turbulence Models; Turbulent Boundary Layer; Turbulent Mixing

20100019487 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Statistical Relevance of Vorticity Conservation with the Hamiltonian Particle-Mesh Method
Dubinkina, Svetlana; Frank, Jason; August 07, 2009; 28 pp.; In English
Report No.(s): PB2010-108103; MAS-E0907; Copyright; Avail.: National Technical Information Service (NTIS)

We conduct long simulations with a Hamiltonian particle-mesh method for ideal fluid flow, to determine the statistical

mean vorticity field. Lagrangian and Eulerian statistical models are proposed for the discrete dynamics, and these are compared against numerical experiments. The observed results are in excellent agreement with theoretical models, as well as the continuum statistical mechanical theory for ideal flow developed by Ellis, Haven and Turkington. In particular the results verify that the apparently trivial conservation of potential vorticity along particle paths using the HPM method significantly influences the mean state. As a side note, the numerical experiments show that a nonzero fourth moment of potential vorticity can influence the statistical mean.
NTIS
Computational Fluid Dynamics; Statistical Mechanics; Vorticity

20100019492 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Finite-Volume Discretizations and Immersed Boundaries
Hassen, Yunus J.; Koren, Barry; June 2009; 44 pp.; In English
Report No.(s): PB2010-108102; MAS-E0906; Copyright; Avail.: National Technical Information Service (NTIS)

In this report, an accurate method, using a novel immersed-boundary approach, is presented for numerically solving linear, scalar convection problems. As is standard in immersed-boundary methods, moving bodies are embedded in a fixed 'Cartesian' grid. The essence of the present method is that specific fluxes in the vicinity of a moving body are computed in such a way that they accurately accommodate the boundary conditions valid on the moving body. To suppress wiggles, tailor-made limiters are introduced for these special fluxes. The first results obtained are very accurate, without requiring much computational overhead. It is anticipated that the method can readily be extended to real fluid-flow equations.
NTIS
Boundaries; Finite Volume Method; Monotone Functions

20100019495 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Physical Five-Equation Model for Compressible Two-Fluid Flow, and Its Numerical Treatment
Kreeft, Jasper J.; Koren, Barry; June 2009; 38 pp.; In English
Report No.(s): PB2010-108101; MAS-E0905; Copyright; Avail.: National Technical Information Service (NTIS)

A novel five-equation model for inviscid, non-heat-conducting, compressible two-fluid flow is derived, together with an appropriate numerical method. The model uses flow equations based on conservation laws and exchange laws only. The two fluids exchange momentum and energy, for which source terms are derived from fundamental physical laws. The Riemann invariants of the governing equations are derived, and used in the construction of an Osher-type approximate Riemann solver. A consistent finite-volume discretization of the source terms is proposed. The source terms have distinct contributions in the cell domain and at the cell faces. For the source-term evaluation at the cell faces, the Riemann solver is elegantly exploited. Numerical results are presented for shock-tube and shock-bubble-interaction problems. The resemblance with experimental results is very good. Free-surface pressure oscillations do not occur, without any precaution. The paper contributes to state of the art in computing two-fluid flows.
NTIS
Compressible Flow; Mathematical Models; Multiphase Flow; Numerical Analysis

20100019532 Michigan Univ., Ann Arbor, MI, USA; Maryland Univ., College Park, MD, USA; Wisconsin Univ., Madison, WI, USA; Sandia National Labs., Albuquerque, NM USA
Terascale High-Fidelity Simulations of Turbulent Combustion with Detailed Chemistry (TSTC)
Im, H. G.; Trouve, A.; Rutland, C. J.; Chen, J. H.; Jan. 2009; 9 pp.; In English
Contract(s)/Grant(s): DE-FG02-01ER15227; DE-FG02-01ER15229
Report No.(s): DE2010-946730; No Copyright; Avail.: National Technical Information Service (NTIS)

The TSTC project is a multi-university collaborative effort to develop a high-fidelity turbulent reacting flow simulation capability utilizing terascale, massively parallel computer technology. The main paradigm of our approach is direct numerical simulation (DNS) featuring highest temporal and spatial accuracy, allowing quantitative observations of the fine-scale physics found in turbulent reacting flows as well as providing a useful tool for development of sub-models needed in device-level simulations. The code named S3D, developed and shared with Chen and coworkers at Sandia National Laboratories, has been enhanced with new numerical algorithms and physical models to provide predictive capabilities for spray dynamics, combustion, and pollutant formation processes in turbulent combustion. Major accomplishments include improved characteristic boundary conditions, fundamental studies of auto-ignition in turbulent stratified reactant mixtures, flame-wall interaction, and turbulent flame extinction by water spray. The overarching scientific issue in our recent investigations is to

characterize criticality phenomena (ignition/extinction) in turbulent combustion, thereby developing unified criteria to identify ignition and extinction conditions. The computational development under TSTC has enabled the recent large-scale 3D turbulent combustion simulations conducted at Sandia National Laboratories.
NTIS
Combustion; Extinction; Flames; Simulation; Turbulent Combustion

20100019564 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thermoelectric Converter for Loop Heat Pipe Temperature Control: Experience and Lessons Learned
Ku, Jentung; Ottenstein, Laura; [2010]; 15 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain, Spain; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019564

This paper describes the theoretical background and implementation methodology of using a thermoelectric converter (TEC) for operating temperature control of a loop heat pipe (LHP). In particular, experimental results from ambient and thermal vacuum tests of an LHP are presented for illustrations. The most commonly used state-of-the-art method to control the LHP operating temperature is to cold bias its compensation chamber (CC) and use an electrical heater to maintain the CC at the desired set point temperature. Although effective, this approach has its shortcomings in that the electrical heater can only provide heating to the CC, and the required power can be large under certain conditions. An alternative method is to use a TEC, which is capable of providing both heating and cooling to the CC. In this method, one side of the TEC is attached to the CC, and the other side is connected to the evaporator via a thermal strap. Using a bipolar power supply and a control algorithm, a TEC can function as a heater or a cooler, depending on the direction of the current flow. Extensive ground tests of several LHPs have demonstrated that a TEC can provide very tight temperature control for the CC. It also offers several additional advantages: (1) The LHP can operate at temperatures below its natural operating temperature at low heat loads; (2) The required heater power for a TEC is much less than that for an electrical heater; and (3) It enhances the LHP start-up success. Although the concept of using a TEC for LHP temperature control is simple, there are many factors to be considered in its implementation for space applications because the TEC is susceptible to the shear stress and yet has to sustain the dynamic load under the spacecraft launch environment. The added features that help the TEC to withstand the dynamic load will inevitably affect the TEC thermal performance. Some experiences and lessons learned are addressed in this paper.
Author
Heat Pipes; Thermoelectric Generators; Temperature Effects; Temperature Control; Evaporators; Dynamic Loads

20100019628 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Edinburgh Univ., UK
Thermostat Closure for Point Vortices
Dubinkina, Svetlana; Frank, Jason E.; Leimkuhler, Ben L.; January 2009; 22 pp.; In English
Report No.(s): PB2010-107598; MAS-E0909; Copyright; Avail.: National Technical Information Service (NTIS)

Using the point vortex flow on a disc as a prototype, we present a closure for incompressible ideal fluid flow in the form of a generalized thermostating device. The thermostat can model either an innite or nite reservoir. The thermostat variables are stochastically forced. Numerical experiments are in excellent agreement with the two-scale simulations of Buhler.
NTIS
Thermostats; Vortices

20100019971 Georgia Inst. of Tech., Atlanta, GA USA
Fluidic Actuation and Control of Munition Aerodynamics
Glezer, Ari; Aug 31, 2009; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-1-0345
Report No.(s): AD-A519561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 3-year program focused on fundamental approaches to control of aerodynamic steering forces and moments on a wire-mounted subsonic projectile model by fluidic modification of their apparent aerodynamic shape. This approach exploits transitory interactions of projectile-integrated synthetic jet actuators with the cross flow to induce localized flow attachment and thereby alter the global aerodynamic forces and moments. The actuation effects were assessed using force and moment measurements, PIV, and time-resolved force measurements.
DTIC
Aerodynamic Forces; Aerodynamics; Control Equipment; Fluidics

20100019985 Air Force Research Lab., Wright-Patterson AFB, OH USA

Capacity of 718Plus (registered trademark) for Structural Gas Turbine Engine Components (Preprint)

Uchic, Michael; Peterson, Benjamin; Krishnan, Venkatesh; Brayshaw, Dave; Helmink, Randy; Oppenheimer, Scott; Ott, Eric; Benn, Ray; Apr 2010; 17 pp.; In English

Contract(s)/Grant(s): FA8650-06-2-5211; Proj-4347

Report No.(s): AD-A519598; AFRL-RX-WP-TP-2010-4162; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent developments from the cast 718Plus(R) Metals Affordability Initiative (MAI) program will be presented and discussed. The objective of the program is to investigate and enable the use of 718Plus(R) (hereinafter referred to as 718Plus) in the form of investment castings by (1) increasing the allowable operating temperature by about 75 degrees F as compared with conventional cast Alloy 718 and (2) achieve approximately 25 percent cost savings as compared with cast Waspaloy. This program builds on the successful MAI program for wrought 718Plus. This technology will be implemented for the manufacture of gas turbine structural components including: combustor plenums, stator cases, diffuser cases, turbine cases, turbine frames, and other various high-strength/high-temperature structural castings. An overview of the results from the castability, weldability, and initial mechanical property investigations will be discussed. A preliminary cost benefit to aerospace components after implementation is predicted to be substantial. This recent work has warranted further investigation through the MAI program.

DTIC

Gas Turbine Engines; Gas Turbines; Mechanical Properties; Metals; Structural Design; Turbines

20100020011 Oregon State Univ., Corvallis, OR USA

Prediction of Hydrodynamics for Unidirectional Flow

Ozkan-Haller, H T; Jan 2007; 5 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0852

Report No.(s): AD-A519668; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the next two years our aim is to transition from the study of nearshore currents to the study of river current. Our approach is to apply methods used in nearshore circulation (in particular longshore current predictions) to the prediction of flow in riverine environments. Specific objectives are: 1. Complete work on publications related to circulation in the nearshore zone currently under preparation. 2. Carry out a focused study for the application of variational data assimilation (DA) methods to steady state river problems using simple dynamical models for the flow field. The work will be geared towards obtaining estimates of upstream conditions, frictional parameters and channel topography given observations of stream velocities at several locations. This work will be carried out in two phases Assess the utility of a shelf/surf zone circulation model (e.g. ROMS) in determining the 2D flow field in a river setting. Implement variational DA into a simple 1D river flow model (assuming a straight channel and no cross-stream flow). Use a simple 2DH formulation for flow in a meandering stream and apply variational DA methodology in this more realistic 2D setting.

DTIC

Hydrodynamics; Rivers

20100020041 Arizona Univ., Tucson, AZ USA

Numerical Investigation of 3-D Separation: DNS, LES and URANS

Fasel, H F; Gross, A; Jacobi, R; Kremheller, A; May 2010; 79 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-1-0401

Report No.(s): AD-A519795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For Navy relevant geometries, separation of wall bounded flows is a highly complex phenomenon. The combination of three-dimensionality and unsteadiness results in a highly complex time-dependent topology of the separated region. In a combined numerical/experimental effort we investigated laminar separation bubbles in external flows. We employed highly-resolved direct numerical simulations to obtain a deeper understanding of the various physical mechanism governing separation, transition, and reattachment. We also carried out and hybrid RANS/LES simulations for a turbulent square-duct and the Stanford University asymmetric diffuser.

DTIC

Boundary Layer Separation; Direct Numerical Simulation; Separated Flow; Three Dimensional Flow

20100020193 Air Force Research Lab., Hanscom AFB, MA USA
Similarity of the Outer Region of the Turbulent Boundary
Weyburne, David W.; February 9, 2009; 94 pp.; In English
Contract(s)/Grant(s): Proj-4916
Report No.(s): AD-A519314; AFRL-RY-HS-TR-2010-0013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

New similarity criteria are obtained for the velocity profile and the Reynolds stress terms by a stream function approach using the transformed x-momentum balance equation and the transformed Reynolds stress transport equation. The similarity criteria are similar to earlier results but are developed without a priori assumptions as to the velocity or Reynolds stress term scaling variables. Using the criteria, eleven experimental datasets for turbulent flow on a wedge are found. Scaling results indicate that the displacement thickness, the momentum thickness, the ninety-nine percent thickness, and the Rota-Clauser thickness all work as the outer region similarity thickness scale. The experimental and theoretical evidence indicates the free stream velocity works well as the velocity scaling parameter. For the Reynolds stress scaling. experimental evidence is for the most part ambiguous. However. recent DNS results clearly indicate that the friction velocity squared is the proper scaling but this result is seemingly at odds with the new theoretical criteria. Resolution of the conflict is made by the observation that similarity?like behavior of the velocity profile and the Reynolds stress terms are only obtained for the flow datasets where the ratio of the free stream velocity to the friction velocity is almost constant.
DTIC
Analogies; Boundaries; Turbulence; Turbulent Boundary Layer

20100020195 Air Force Research Lab., Hanscom AFB, MA USA
Similarity Scaling for the Inner Region of the Turbulent Boundary Layer
Weyburne, David W.; November 20, 2009; 34 pp.; In English
Contract(s)/Grant(s): Proj-4916
Report No.(s): AD-A519312; AFRL-RY-HS-TR-2010-0012; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For the first time it is shown that the Prandtl length scale has a natural interpretation in terms of the physical structure of the boundary layer for a 2-0 wall bounded flow. Both the Prandtl length scale and a newly developed parameter are first moments associated with the mean location value of the second derivative of the velocity profile. These two parameters therefore track the mean location of the viscous forces present in the boundary layer. A simple mathematical proof is offered to show that the new parameter must be a similarity scaling parameter for all 2-0 boundary layer flows. From the parameter definitions, one can show that the new scaling parameter is identical to the Prandtl parameter scaling for the case where the ratio of the free stream velocity at the boundary layer edge to the Prandtl scaling velocity, the so called friction velocity, is a constant. This similarity condition is found in certain turbulent boundary layer flow data sets. We show that to experimental accuracy, a subset of these datasets exhibit whole profile similarity using the new scaling parameters if one assumes that the reported skin friction coefficients are in error by +-10%. The results lead to a new conceptual picture for similarity of the turbulent boundary layer.
DTIC
Analogies; Turbulent Boundary Layer

20100020272 Air Force Research Lab., Hanscom AFB, MA USA
The Mathematics of Flow Similarity of the Velocity Boundary Layer
Weyburne, David W.; December 11, 2008; 26 pp.; In English
Contract(s)/Grant(s): Proj-4916
Report No.(s): AD-A519319; AFRL-RY-HS-TR-2010-0014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

New results for similarity scaling of the velocity profile of the 2-D wall-bounded flows are presented. The theoretical results are based on a simple concept; the area under similar scaled velocity profile curves must be equal. By taking certain integrals of the scaled velocity profiles and its first derivative, we obtain a number of similarity scaling requirements. For example, it is shown that if whole profile similarity exists, then: 1) the similar length scaling variable must be proportional to the displacement thickness, and 2) the velocity similarity scaling variable must be proportional to the free-stream velocity. Conventional thinking is that whole profile similarity is limited to laminar flow boundary layers. If true, this would drastically restrict the utility of the new scaling results. However, we show that to experimental accuracy, certain turbulent boundary layer flow datasets can display whole profile similarity and that as predicted the new scaling works well. In addition, we develop

new definitions for partial similarity for the inner, the outer, and the log law regions of a turbulent boundary layer. These definitions are most suitable for quantifying similarity of experimental profiles.
DTIC
Analogies; Boundary Layers; Flow Velocity; Laminar Boundary Layer; Turbulent Boundary Layer; Velocity Distribution

20100020323 Air Force Research Lab., Hanscom AFB, MA USA
New Shape Parameters for the Laminar, Transitional, and Turbulent Velocity Profiles
Weyburne, David W.; December 15, 2008; 22 pp.; In English
Contract(s)/Grant(s): Proj-4916; 624916
Report No.(s): AD-A519321; AFRL-RY-HS-TR-2010-0016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this report a new method for describing the shape and thickness of 2-D wall bounded boundary layer velocity profiles is presented. The new method is based on calculating parameters using simple integrals of the velocity profile. It is shown that these new parameters can be used to describe both the inner and outer region of the turbulent boundary layer, as well as laminar and transitional velocity profiles. Applied to experimental laminar-turbulent profiles, it is shown that one of the new shape parameters foretells the beginning of the laminar turbulent transition on a flat plate at a much lower Reynolds number than the traditional H12 criteria. Furthermore, using another new parameter it is shown that the transition to fully turbulent flow may proceed as a discontinuous event.
DTIC
Shapes; Turbulence; Turbulent Boundary Layer; Velocity Distribution

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INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20100018615 Science Applications International Corp., Washington, DC USA
Machine Learning Approach for Target Selection and Threat Classification of Wide Area Survey Data
McDonald, Jim R; Opitz, David W; Blundell, Stuart; Dec 2007; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W912HQ-07-C-0023; Proj-SERDP-MM-1570
Report No.(s): AD-A517700; SERDP-MM-1570; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517700

This project had its genesis in the FY-2007 SERDP Proposal Cycle as proposal 07 MM04-007. Following the sale of AETC to SAIC in November 2006, the project was awarded to SAIC by HECSA as Contract Number W912HQ-07-C-0023. The Project Plan calls for applying the techniques developed during the previous projects, UX1322 and UX1455 to the vehicular and airborne Wide Area MTADS surveys of western desert ranges. In project UX-1455 we demonstrated that using machine learning techniques inherent to the Feature Analyst software it is possible to autonomously identify, with high confidence and accuracy, nearly all of the UXO in a survey dataset. Furthermore, we showed the technology could significantly reduce the number of false positives using a two-pass workflow in Feature Analyst with the Target Picker and Target Ranker modules operating (sequentially) separately from each other.
DTIC
Ammunition; Explosives Detection; Machine Learning; Reconnaissance; Targets; Threat Evaluation

20100018685 Naval Research Lab., Washington, DC USA
Joint Demodulation of Low-Entropy Narrowband Cochannel Signals
Meehan, T; Kragh, F; Clark, K; Jan 2007; 5 pp.; In English
Report No.(s): AD-A517874; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517874

Many receivers today operate in an interference-limited environment. In a dense signal environment, the performance of a receiver is limited by interference from multiple signals at the receiver rather than signal-to-noise ratio. In the interference-limited environment, there is a diminishing return from investing additional resources into improving traditional receiver parameters such as noise figure. Advanced processing techniques exist that can help recover information that would

otherwise be lost using a single-channel receiver. This work investigates some of these techniques. Interference may originate from many sources, such as users on the same or adjacent frequency band, unintended emissions, and intermodulation. This work investigates interference from cochannel information bearing signals. Cochannel interference is commonly defined as the reception of two or more signals at the receiver overlapping in frequency and in time.
DTIC
Demodulation; Entropy; Narrowband

20100018710 Colorado Univ., Boulder, CO USA
Characterization of Noise Properties in Photodetectors: A Step Toward Ultra-Low Phase Noise Microwaves
Taylor, J; Quinlan, F; Diddams, S; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517943; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517943

Very-low-noise microwave signals are desirable for many state-of-the-art applications, including many types of radar and imaging systems. However, even state-of-the-art rf oscillator technology for producing signals into the tens of gigahertz range does not generate signals with low enough phase noise for these important systems to work to their full potential. A new approach for achieving microwave signals with ultra-low phase noise involves using an optical frequency divider that has as its reference a narrow-linewidth CW laser. Femtosecond laser frequency combs provide an effective and efficient way to take an ultra-stable optical frequency reference and divide the signal down into the microwave region. In order to convert optical pulses into a usable rf signal, one must use high-speed photodetection; unfortunately, excess phase noise from both technical and fundamental sources can arise in the photodetection process. In order to ultimately minimize the noise effects of the photodetector, we must first characterize some of the known sources for noise arising in these devices. In this paper, we will study two sources of excess noise in highspeed photodiodes -- power-to-phase conversion and shot noise. The noise performance of each device will give us clues as to the nature of the sources, their effect on the output signal, and what design features of the photodiode minimize these noise effects.
DTIC
Extremely Low Frequencies; Low Noise; Microwaves; Photometers; Shot Noise

20100018754 Naval Research Lab., Washington, DC USA
Highly Efficient Surface Enhanced Raman Scattering (SERS) Nanowire/Ag Composites
Prokes, S M; Glembocki, O J; Rendell, R W; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518047; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518047

Optically based sensing provides advantages over electronic sensing because optical spectra can uniquely fingerprint a chemical compound, significantly reducing false alarms and simplifying the detection process. In addition, light can easily be directed over long distances, enabling remote sensing. One of the most promising optical sensing techniques is surface enhanced Raman scattering (SERS). In Raman scattering (RS) of light from a chemical of interest, the vibrational modes in the chemical redshift the frequency of the scattered light, producing a spectrum characteristic of that molecule. Ordinary Raman scattering cross-sections are very small, resulting in low sensitivity (1E-8 of the intensity of the exciting laser); this is not a problem for most solids and liquids, because of the large numbers of molecules or atoms exposed to the laser light, but in the case of trace amounts of molecules in gases or liquids, detection through ordinary Raman scattering is virtually impossible. However, SERS enhances the Raman signal by many orders of magnitude by the use of a substrate of metal nanoparticles. The SERS enhancement of molecules adsorbed on the roughened metal surface is caused by local electromagnetic fields that are created by the laser excitation of surface plasmons at the metal surface. Even larger SERS effects can be produced by local hot spots in the electric fields, produced by interactions of localized plasmons on adjacent or neighboring nanoparticles. Although the SERS effect has been recognized for a long time, a full understanding of the phenomenon has not yet been achieved. This lack of understanding limits its application potential, as it is difficult to produce highly sensitive, inexpensive, and repeatable SERS substrates. To address these issues, we have developed a new SERS substrate material consisting of dielectric/Ag metal shell nanowires that exhibit high SERS sensitivity due to their plasmonic coupling.
DTIC
Detection; Nanowires; Optical Measurement; Raman Spectra; Scattering Cross Sections

20100018791 Pennsylvania State Univ., University Park, PA USA

Fusion Driven Dynamic Space-Time Clustering for Sensor Networks

Phoha, Shashi; Madan, Bharat B; Kock, John; Jan 2008; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-1-0376

Report No.(s): AD-A518138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518138

Sensors require physical interaction with the sensed phenomena and are subject to a number of noise factors. Moreover, sensor data is highly correlated across a subset of sensors in the vicinity of a stimulus. To get reliable performance from individually less reliable sensors, time-critical collaborative inference in the vicinity of a stimulus is necessary to circumvent limitations of sensing, communications, power, and equipment faults. Dynamic space-time clustering (DSTC) is the ability of a sensor network to support such collaborative inferencing in the presence of physical stimuli. In this paper we present the DSTC algorithm for tracking events and targets by deploying a sensor field in the surveillance region. The computationally efficient DSTC algorithm leverages its performance by facilitating collaboration between sensors by way of sensor data fusion. To conserve network bandwidth required for sensor data fusion, we use a probabilistic finite state-machine model based on the symbolic dynamics theory to extract useful information from time series data that represents the raw sensor data. Such a model is capable of extracting maximum useful information in the form a probabilistic finite state machine. This paper describes protocols required to carry out DSTC and to adaptively reconfigure the network, in-situ, to capture the statistical characteristics of emerging change in the information dynamics. Building on this framework, we present an urban area application that requires adaptive sensor networks to dynamically cluster sensing, processing and communications resources in space-time neighborhoods of emergent hotspots for progressively fine grained sampling and prediction, and collaborate with other dynamic clusters for event tracking.

DTIC

Algorithms; Detection; Multisensor Fusion; Networks; Target Acquisition; Tracking (Position)

20100018809 Naval Research Lab., Washington, DC USA

A Multi-Sensor Aerogeophysical Study of Afghanistan

Brozena, J; Childers, V; Gardner, J; Liang, R; Jarvis, J; Bowles, J; Jan 2007; 10 pp.; In English

Report No.(s): AD-A518204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518204

A multi-sensor, multidisciplinary aerogeophysical survey over much of Afghanistan was recently conducted by investigators from NRL and the U.S. Geological Survey. The survey was flown aboard an NP-3D Orion aircraft operated by VXS-1. Sensor systems installed on the P-3 included dual gravimeters, scalar and vector magnetometers, a digital photogrammetric camera, a hyperspectral imager, and an L-band polarimetric synthetic aperture radar. Data from all sources was precisely co-registered to the ground by a combination of interferometric-mode Global Positioning System and inertial measurements. The data from this integrated mapping mission supports numerous efforts in Afghanistan: combat operations, economic exploration for oil, gas, and minerals, humanitarian missions, development of civil infrastructure, and agriculture resource management. This mission has also advanced the state of the art in integrated multi-sensor airborne remote sensing.

DTIC

Afghanistan; Geological Surveys; Geophysics; Imagery; Multisensor Applications; Photogrammetry

20100018960 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Characterization and Measurement of Passive and Active Metamaterial Devices

Lundell, Christopher A; Mar 2010; 242 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518568; AFIT/GE/ENG/10-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document addresses two major obstacles facing metamaterial development: uncertainty in the characterization of electromagnetic field behavior in metamaterial structures and the relatively small operational bandwidth of metamaterial structures. To address the first obstacle, a new method to characterize electromagnetic field behavior in a metamaterial is presented. This new method is a bistatic radar cross section (RCS) measurement technique. RCS measurements are well-suited to measuring bulk metamaterial samples because they show frequency dependence of scattering angles and offer common postprocessing techniques that can be useful for visualizing results. To address the second obstacle, this document characterizes the effectiveness of an adaptive metamaterial design that incorporates a microelectromechanical systems (MEMS) variable capacitor. Applying voltages to the MEMS device changes the resonant frequency of the metamaterial. In this research, computational models show that the size of the adaptive metamaterial unit cell should be increased to improve

the responsiveness of the resonant frequency to changes in the MEMS capacitor.
DTIC
Capacitors; Electromagnetic Fields; Frequencies; Microelectromechanical Systems; Multistatic Radar; Radar Cross Sections; Resonant Frequencies

20100018973 Naval Postgraduate School, Monterey, CA USA
NDVI and Panchromatic Image Correlation Using Texture Analysis
Jablonski, David A; Mar 2010; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518596; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to apply panchromatic satellite imagery to the task of locating kelp in the California coastal waters. The task is currently done using multi-spectral imagery (MSI), but there are time intervals wherein only panchromatic data are available. Panchromatic images were analyzed using various threshold approaches, analysis techniques, and texture analysis. Results were then compared to MSI data analyzed using the standard Normalized Difference Vegetation Index (NDVI). Four classification methods were used: Maximum Likelihood, Mahalanobis Distance, Minimum Distance, and Binary Encoding. The main problem with this approach was sunglint off of the water. It proved difficult to eliminate all of it in the classification of kelp. The Receiver Operating Characteristic (ROC) curves proved that the panchromatic and variance texture feature images were well above the line of no-discrimination, so they are a very good detector and discriminator of kelp and water. Using panchromatic and variance in the Mahalanobis Distance, and Minimum Distance classification methods, the result is an overall accuracy of 98.5% of the Santa Barbara Coastal Long-Term Ecological Research (SBC-LTER) Program research areas of Arroyo Burro and Mohawk.
DTIC
Aquatic Plants; Coasts; Ecosystems; Image Correlators; Normalized Difference Vegetation Index; Photographs; Satellite Imagery; Seaweeds; Textures

20100018975 Arizona Univ., Tucson, AZ USA
Cognitive Radar
Goodman, Nathan A; Feb 28, 2010; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-07-1-0182
Report No.(s): AD-A518604; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several advances were made toward a foundation for cognitive radar. Several extensions to optimum or matched waveform theory were completed, including formalization of a random-target variance function used in the design methods, extensions to MIMO radar for target identification, information-based waveforms in the presence of ground clutter, incorporation of constant-modulus design techniques, and an adaptive PRK selection technique. These techniques were also applied to spatial waveform design (i.e. beamshaping) in order to develop the fundamentals for a cooperative multiplatform air-to-ground surveillance capability. Two techniques based on the covariance of target track states were developed for integrating detection and tracking into the same Bayesian framework, as well as probability updating techniques in target parameter space for multi-platform detection and tracking. This allowed for beamsteering toward areas in a scene where target presence and/or parameters were most uncertain.
DTIC
Cognition; Radar; Radar Tracking

20100019027 Sandia National Labs., Albuquerque, NM USA
Clutter in the GMTI Range-Velocity Map
Doerry, Armin W; Apr 2009; 61 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): AD-A518732; SAND2009-1797; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ground Moving Target Indicator (GMTI) radar maps echo data to range and range-rate, which is a function of a moving target's velocity and its position within the antenna beam footprint. Even stationary clutter will exhibit an apparent motion spectrum and can interfere with moving vehicle detections. Consequently it is very important for a radar to understand how stationary clutter maps into radar measurements of range and velocity. This mapping depends on a wide variety of factors, including details of the radar motion, orientation, and the 3-D topography of the clutter.
DTIC
Clutter; Mapping; Moving Target Indicators; Radar Maps

20100019211 Air Force Research Lab., Wright-Patterson AFB, OH USA
Effects of Multiple Photon Scattering in Deciduous Tree Canopies
Greiner, Michael; Duncan, Bradley D; Dierking, Matthew P; Dec. 2009; 76 pp.; In English
Contract(s)/Grant(s): Proj-2003
Report No.(s): AD-A518678; AFRL-RY-WP-TR-2010-1024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Detecting objects hidden beneath forest canopies has proven to be a difficult task for optical remote sensing systems. Rather than relying upon the existence of gaps between the leaves, our goal was to use the light that is scattered from the leaves to image through dense foliage. We developed a Monte Carlo canopy propagation model to simulate the scattering of light through a maple tree canopy. We measured several forest parameters, including the gap fraction and maximum leaf area density of a real test canopy and applied them to the model. We ran the simulation for 80 deg illumination and reported on the results in the ground and receiver planes. We then authenticated the validity of the model by illuminating a test forest at an 80 deg angle, collecting data both on the canopy floor and in a monostatic receiver, and comparing the results to the simulation. Additionally, we examined the accuracy of the model in accounting for seasonal canopy variations and verify the simulation with experimental results. Lastly, we investigated methods for boosting the signal-to-noise ratio (SNR) of detected photons and make SNR calculations for various illumination angles.
DTIC
Canopies (Vegetation); Deciduous Trees; Optical Equipment; Photons; Remote Sensors; Scattering; Trees (Plants)

20100019350 National Science and Technology Council, Washington, DC USA
Biometrics in Government, Post-9/11: Advancing Science, Enhancing Operations
Aug. 2008; 90 pp.; In English
Report No.(s): AD-A518300; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report, prepared by the National Science and Technology Council (NSTC) Subcommittee on Biometrics and Identity Management, documents key US Government initiatives to advance the science of biometrics and assesses their value in meeting critical operational needs. While federal efforts in biometric technologies predate the terrorist attacks of September 2001 by several decades, this report focuses on progress made since then. Working through the NSTC, and in cooperation with the academic and industrial research communities, agencies embarked on a multi-year initiative to advance the capabilities of biometric technologies. As capabilities advanced, agencies quickly incorporated them into their operational systems and then worked to develop government-wide policies on how to use biometrics to support missions against known and suspected terrorists, while simultaneously enhancing privacy protection for US Citizens and foreign visitors. By developing a common planning focus for departments and agencies we have advanced the technology and its operational implementation at a far greater pace than would have been possible otherwise. Today, federal agencies are using biometrics to enhance security and operational efficiency throughout the nation, at the borders and in the battlefields of Afghanistan and Iraq. Their continued efforts to meet the ongoing needs outlined in The National Biometrics Challenge will ensure even greater successes in the future.
DTIC
Biometrics; Security

20100019401 Department of Energy, Washington, DC, USA
ACRF Instrumentation Status: New, Current, and Future. (March 2009)
Voyles, J.; March 2009; 20 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2010-952497; DOE/SC-ARM/P-09-004.3; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of this report is to provide a concise but comprehensive overview of Atmospheric Radiation Measurement Climate Research Facility instrumentation status. The report is divided into the following five sections: (1) new instrumentation in the process of being acquired and deployed, (2) field campaigns, (3) existing instrumentation and progress on improvements or upgrades, (4) proposed future instrumentation, and (5) Small Business Innovation Research instrument development.
NTIS
Atmospheric Radiation; Radiation Measurement; Research Facilities; Measuring Instruments

20100019438 C and P Technologies, Inc., Closter, NJ USA; Polytechnic Univ., Brooklyn, NY, USA; Guerci Consulting, Arlington, VA, USA

Efficient Wideband Processing Without Subbanding (Preprint)

Li, Ke Yong; Pillai, S. Unnikrishna; Guerci, Joseph R.; Aug. 2007; 7 pp.; In English; IEEE Radar Conference (2008), 26-30 May 2008, Rome, Italy

Contract(s)/Grant(s): FA8750-06-C-0117; Proj-5017

Report No.(s): AD-A518268; AFRL-RY-WP-TP-2009-1309; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518268

A new method for wideband spatio-temporal processing in the context of clutter mitigation and target detection is addressed in this paper. The frequency dependent, spatio-temporal steering vectors, are separated using a series expansion that depends on a sequence of Bessel function terms, and this is used to focus data vectors corresponding to various frequency components to a single frequency component. As a result, narrowband space-time adaptive processing (STAP) can be carried out on the focused data vector for clutter mitigation and target detection.

DTIC

Adaptation; Broadband; Clutter; Detection; Radar; Space-Time Adaptive Processing; Target Acquisition

20100019536 Army Research Lab., Aberdeen Proving Ground, MD USA

A Ballistic Filter for GPS and Accelerometer Measurements

Thompson, Andrew A; Apr 2010; 44 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518127; ARL-TR-5144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518127

This report extends the work of Andrew A. Thompson described in the report titled Ballistics Filtering, ARL-TR-4735, published in March 2009, by showing the process of realizing the ideas through a simulation. By providing a concrete example it is hoped other realizations of the ideas can be pursued with a reasonable effort. Ballistic Filtering describes the dynamic equations that can be used to form Extended Kalman Filters (EKF) for the estimation of a projectile's trajectory. The steps associated with initialization and implementing an EKF are demonstrated through a specific task. The performance of an EKF processing Global Positioning System (GPS) observations is compared to the performance of an EKF processing both GPS and axial accelerometer observations.

DTIC

Accelerometers; Ballistics; Global Positioning System; Kalman Filters

20100019653 Miami Univ., Coral Gables, FL USA

Use of the Polarized Radiance Distribution Camera System in the RADYO Program

Voss, Kenneth J; Jan 2008; 5 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0720

Report No.(s): AD-A518866; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518866

My work involves experimentally investigating the interrelationships and variability of optical properties in the ocean and atmosphere. My goal is to define the variability of the optical properties, particularly those dealing with light scattering, and to improve the prediction capabilities of image and radiative transfer models used in the ocean. My near term ocean optics objectives have been: 1) to improve the measurement capability of measuring the in-water and above-water spectral radiance distribution and extending this capability to polarization, 2) to investigate the variability of the Point Spread Function (PSF) as it relates to the imaging properties of the ocean, and 3) to improve the characterization of the Bi-directional Reflectance Distribution Function (BRDF) of benthic surfaces in the ocean, and 4) to understand the capabilities and limitations of using radiative transfer to model the BRDF of particulate surfaces. The major objective of this research is to understand the downwelling spectral polarized radiance distribution, in the near surface of the ocean.

DTIC

Bidirectional Reflectance; Cameras; Distribution Functions; Light Scattering; Oceans; Point Spread Functions; Radiance

20100019721 Missile Defense Agency, Washington, DC USA
Mobile Sensors Environmental Assessment
Sep 26, 2005; 275 pp.; In English
Report No.(s): AD-A519044; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519044

The Missile Defense Agency (MDA) prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts of the use of mobile sensors (i.e., radar, telemetry, command and control, and optical systems) from land-based platforms and the use of airborne sensor systems. The use of mobile sensors from sea-based platforms was analyzed in the Mobile Launch Platform Environmental Assessment (Missile Defense Agency [MDA], 2004). This EA considers impacts associated with the proposed use of land-based mobile sensors and airborne sensor systems on targets of opportunity. Where appropriate this EA also considers environmental impacts from specific tests identified by the MDA that are proposed to use land-based mobile sensors and airborne sensor systems. Finally, the EA addresses cumulative impacts associated with test events using mobile sensors from land-based platforms and airborne sensor systems. The purpose of the proposed action is to provide increasingly robust and comprehensive realistic test surveillance and tracking data capabilities in support of the MDA's mission to implement an integrated and effective Ballistic Missile Defense System (BMDS). As BMDS capabilities advance, testing events becomes increasingly complex. Sensors are needed at additional locations to capture data from these events. Mobile land- and airbased sensors provide a more versatile and cost effective method for meeting this requirement than construction of fixed assets at required locations. The proposed action requires the transport, set-up, and operation of mobile land-based sensors (i.e., radar, telemetry, command and control, and optical systems) from land-based platforms and setup and operation of airborne sensor systems.
DTIC
Detectors; Missiles

20100019722 Optech International, Inc., Kiln, MS USA
Countermine Lidar UAV-based System (CLUBS)-Year 2 (extended)
Tuell, Grady H; Jan 2008; 8 pp.; In English
Contract(s)/Grant(s): N00014-05-C-0417
Report No.(s): AD-A519054; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519054

The long-term goal of this work is to examine the utility of commercial bathymetric lidar technology solely, and in combination with commercial passive imaging spectrometers, for measuring environmental information for military applications in the littoral zone. These findings will indicate how commercial systems might evolve to achieve improved performance for rapid environmental assessment and for deployment in unmanned aerial vehicles. Objectives: 1. Develop capability to produce lidar-only classification of the seafloor. 2. Develop capability to estimate underwater horizontal visibility from bathymetric lidar data. 3. Identify the best strategy for integrating a few spectral channels of passive data with lidar data for seafloor and water column characterization. 4. Assemble combined active and passive datasets over a range of environments and environmental conditions.
DTIC
Bathymeters; Imaging Techniques; Ocean Bottom; Optical Radar

20100019793 Tanner Research, Inc., Monrovia, CA USA
A Model for the Detection of Moving Targets in Visual Clutter Inspired by Insect Physiology
Wiederman, Steven D; Shoemarker, Patrick A; O'Carroll, David C; Jul 2008; 12 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0294; FA9550-04-A-0283
Report No.(s): AD-A519270; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519270

We present a computational model for target discrimination based on intracellular recordings from neurons in the fly visual system. Determining how insects detect and track small moving features, often against cluttered moving backgrounds, is an intriguing challenge, both from a physiological and a computational perspective. Previous research has characterized higher-order neurons within the fly brain, known as small target motion detectors (STMD), that respond robustly to moving features, even when the velocity of the target is matched to the background (i.e. with no relative motion cues). We recorded from intermediate-order neurons in the fly visual system that are well suited as a component along the target detection pathway. This full-wave rectifying, transient cell (RTC) reveals independent adaptation to luminance changes of opposite signs (suggesting separate ON and OFF channels) and fast adaptive temporal mechanisms, similar to other cell types previously

described. From this physiological data we have created a numerical model for target discrimination. This model includes nonlinear filtering based on the fly optics, the photoreceptors, the 1st order interneurons (Large Monopolar Cells), and the newly derived parameters for the RTC. We show that our RTC-based target detection model is well matched to properties described for the STMDs, such as contrast sensitivity, height tuning and velocity tuning. The model output shows that the spatiotemporal profile of small targets is sufficiently rare within natural scene imagery to allow our highly nonlinear matched filter to successfully detect most targets from the background. Importantly, this model can explain this type of feature discrimination without the need for relative motion cues.
DTIC
Clutter; Detection; Insects; Mathematical Models; Moving Target Indicators; Photoreceptors; Rectification; Target Acquisition; Targets; Visual Signals

20100019864 Naval Surface Warfare Center, Dahlgren, VA USA
Leading Edge. Sensors Challenges and Solutions for the 21st Century. Volume 7, Issue Number 2
Jan 2010; 119 pp.; In English
Report No.(s): AD-A519289; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Leading Edge Magazine is an official authorized publication of the Naval Warfare Center Enterprise. The purpose of the publication is to showcase technical excellence across the Warfare Center Enterprise, and promote a broader awareness of the breadth and depth of knowledge and support available to the Navy and DoD at NSWC/NUWC.
DTIC
Detectors; Electronic Warfare; Leading Edges; Radar; Technology Assessment

20100019868 Air Force Research Lab., Hanscom AFB, MA USA
Model Order Estimation for Adaptive Radar Clutter Cancellation
Rangaswamy, Muralidhar; Kay, Steven; Xu, Cuichun; Lin, Freeman C; Jan 2007; 6 pp.; In English
Report No.(s): AD-A519297; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Adaptive waveform design for radar clutter cancellation requires knowledge of the rank of the clutter subspace. In this paper, we compare the computed clutter subspace rank, r, using three methods: (i) the exponentially embedded family (EEF) estimator, (ii) Rissanen's minimum description length (MDL) estimator, and (iii) the statistical ranking and selection method (CWA).
DTIC
Cancellation; Clutter; Waveforms

20100019912 Parsons, Huntsville, AL USA
Report Of Environmental Security Technology Certification Program (ESTCP) UXO Discrimination Study Support Activities: Former Camp Sibert, Etowah and St. Clair Counties, Alabama
Nov 2007; 103 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W912DY-04-D-0005-0016
Report No.(s): AD-A519443; No Copyright; Avail.: Defense Technical Information Center (DTIC)
As part of their ongoing efforts to evaluate and advance geophysical discrimination technologies for use at Unexploded Ordnance (UXO) sites, the Environmental Security Technology Certification Program (ESTCP) selected portions of Site 18 at the former Camp Sibert as the site for a UXO discrimination study. Camp Sibert is located near Attalla, Alabama and was utilized as a unit and individual replacements training facility from late 1942 to early 1945. The government terminated the leases for the area on December 13, 1946. After decontamination of various ranges and toxic areas in 1948, the land was declared excess and transferred to private and local government ownership. Site 18 is located within Range 28, the 4.2-inch Mortar Range. Concurrent with the ESTCP discrimination study, an Engineering Evaluation and Cost Analysis (EE/CA) investigation under the Formerly Used Defense Site (FUDS) program was also completed by Parsons at the site. To date, two intact 4.2-inch mortars have been found at Site 18. Munition debris associated with the 4.2-inch mortars has been found over a large portion of Site 18. Relative to Parsons? efforts in support of the discrimination study, our primary objectives were three fold. 1. Provide support services for ESTCP personnel and their demonstrators. 2. Provide a qualified UXO team for seeding and intrusive investigations. 3. Act as one of the demonstrators for the discrimination study performing geophysical surveys and data analysis.
DTIC
Certification; Explosives Detection; Security

20100019989 Duke Univ., Durham, NC USA

AFRL Nanotechnology Initiative: Hybrid Nanomaterials in Photonic Crystal Cavities for Multi-Spectral Infrared Detector Arrays

Stiff-Roberts, Adrienne D; Zhou, Weidong; Mar 31, 2010; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0482

Report No.(s): AD-A519614; 313-6060-602430000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project was to demonstrate the feasibility of a multi-spectral infrared (IR) photodetector using hybrid nanomaterials in photonic crystal (PC) cavities for enhanced absorption at selected wavelengths. The simultaneous sensing of multiple IR wavelengths, particularly in the near-IR and mid-IR is important because it enables intelligent surveillance, target recognition, and chem-bio detection. This project investigated InAs/GaAs epitaxial quanttun dots (EQDs) and colloidal quantum dots (CQDs). By incorporating these nanomaterials in one-dimensional (1D) and two-dimensional (2D) PC cavities, the possibility of multi-spectral configurability and enhanced absorption was explored. It was demonstrated that integrating EQDs with 2D PC cavities (etched air holes) is challenging due to difficulty in matching photonic bandgap defect modes with InAs/GaAs EQD absorption peaks. Nonetheless, enhanced absorption was demonstrated in a specific defect mode at 8 um at low temperatures. In contrast, it was straightforward to enhance absorption at specific wavelengths at room temperature by integrating CQDs with 1D PC cavities (polymer distributed Bragg reflectors). An enabling technology was matrix-assisted pulsed laser evaporation.

DTIC

Cavities; Crystals; Infrared Detectors; Nanotechnology; Photometers

20100019997 Army Space and Missile Defense Command, Huntsville, AL USA

Standing Watch! A Look at Theater Missile Warning Detachments

Coffin, Timothy; Carroll, Joseph; Jan 2007; 3 pp.; In English

Report No.(s): AD-A519636; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The future of Joint Tactical Ground Stations (JTAGS) lies in the ability to receive and process data from multiple sensors being developed and fielded today to provide reports on events creating signatures across the energy spectrum, not only those detected by Space-based missile detection systems. This concept ensures that we avoid data and sensor stovepipes and contribute to a common operational picture. Those sensors include but are not limited to Space-Based Infrared System; Space Tracking and Surveillance System; the Alternative InfraRed Satellite System; other air-based infrared sensors; and ground, air and Space-based radars. This will not only provide a more robust capability to provide critical warning and battlespace awareness to theater commanders, but will also create the ability for JTAGS to support other customers such as the Ballistic Missile Defense System or Missile Defense Agency's kill chain for Aegis, Terminal High-Altitude Area Defense, Kinetic Energy Interceptor, or Patriot engagements. Only JTAGS, by its in-theater ability to integrate directly into the theater's missile warning architecture, and in-theater ability to directly down-link, process, and disseminate warning data, is uniquely suited to meet the Combatant Commanders' requirements for assured timely and accurate missile warning. Expanding today's capabilities enable JTAGS to continue to meet warfighter and commander requirements in the missile threat environment of the future battlefield.

DTIC

Detachment; Early Warning Systems; Ground Stations; Infrared Detectors; Military Operations; Missile Defense; Missiles; Radar

20100020010 Massachusetts Univ., Amherst, MA USA

Radar Measurement of Waves and Currents in the Nearshore Zone

Frasier, Stephen; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0239; N00014-07-1-0337

Report No.(s): AD-A519665; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objectives of this effort are to determine the extent to which Doppler radar techniques can be exploited for both qualitative and quantitative nearshore measurement applications. Of particular interest are estimates of surf zone location, extent, surface currents, and wave parameters. To date, optical (video) techniques have been the primary remote sensing technology for these applications. An advantage of radar is its all-weather, day-night operability.

DTIC

Doppler Radar; Nearshore Water; Radar Measurement

20100020211 Naval Research Lab., Washington, DC USA

Using Morphological Filters for Pupil Detection in Infrared Videos

Shyu, Haw-Jye; Hillson, Roger; Jan 5, 2010; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-55-6010

Report No.(s): AD-A519011; NRL/MR/5508--10-9233; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519011

Patterns of eye movements may be indicative of a subject's cognitive state, including the likelihood that a subject is lying or telling the truth. Medical systems exist for tracking eye movements, but their use requires artificially constraining head movements in a manner that is incompatible with an interview scenario. The eye movement analysis contained in this report was conducted retroactively, using data collected elsewhere using a simple experimental setup. The subjects were photographed using a single camera equipped with a single IR (infrared) illuminator. A three-stage process of morphological filtering was used to detect the subjects' pupils, with manual parameterization of the filter coefficients. False detections due to background clutter from eyeglasses and jewelry were significantly reduced, but not entirely eliminated. Use of an elliptical filter, rather than a circular filter, improved the outcome for the final stage of pupil detection. Although improved methods exist for reducing false detections, the data collection protocols are far more complex than the single-camera/single-illuminator protocol used here.

DTIC

Deception; Eye Movements; Infrared Radiation; Morphology; Pupils

20100020226 Miami Univ., FL USA

Geospatial Video Monitoring of Benthic Habitats Using the Shallow-Water Positioning System (SWaPS)

Lirman, Diego; Deangelo, Greg; Proceedings of the MTS/IEEE Oceans 2007 Conference: Edge of Tomorrow; January 2007; 6 pp.; In English; MTS/IEEE Oceans 2007 Conference: Edge of Tomorrow, 29 Sep. - 4 Oct. 2007, Vancouver, Canada, Canada; Original contains color illustrations

Report No.(s): AD-A518773; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518773

In this project, we describe the application of a geospatial video-based survey technique, the Shallow-Water Positioning System (SWaPS), develop by scientists from NOAA's National Geodetic Survey, to document the abundance, distribution, and damage patterns of benthic organisms in shallow marine habitats that have been historically under-represented in monitoring programs due to the difficulties associated with boat access. SWaPS uses a GPS receiver attached to a video camera. The GPS receiver is centered over the digital video camera that is suspended over a glass enclosure that provides a down-looking view of the bottom. SWaPS is presently available in three platforms used for distinct survey requirements: (a) a boat-based system; (b) a remotely-operated system; and (c) a diver-based system. During the surveys, each video frame recorded is stamped with position information, date, depth, heading, and pitch and roll, and the georeferenced digital frames obtained in these surveys can be easily analyzed to document patterns of abundance and distribution of submerged aquatic vegetation (SAV) and other benthic organisms, as well as damage patterns caused by ship groundings and boat propellers in shallow coastal habitats. The SWaPS methodology provides a fast, spatially precise alternative to diver-based surveys that can be especially useful when: (1) a large number of closely spaced sites need to be surveyed rapidly; (2) field time is limited, as is often the case prior to the onset of an acute disturbance (e.g., hurricane, dredging project); (3) the availability of trained field personnel is limited; (4) resources need to be precisely mapped; (5) a permanent visual archive of the extent and condition of benthic resources is needed; and (6) the same locations need to be surveyed repeatedly without establishing permanent markers.

DTIC

Habitats; Ocean Bottom; Positioning; Shallow Water; Video Signals

20100020237 Minnesota Univ., Minneapolis, MN USA

Learning Multiscale Sparse Representations for Image and Video Restoration

Mairal, Julien; Sapiro, Guillermo; Elad, Michael; Jul 2007; 28 pp.; In English

Report No.(s): AD-A519269; IMA-PREPRINT-SERIES-2168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519269

A framework for learning multiscale sparse representations of color images and video with overcomplete dictionaries is presented in this paper. Following the single-scale grayscale K-SVD algorithm introduced in [1], which formulates the sparse dictionary learning and image representation as an optimization problem efficiently solved via orthogonal matching pursuit

and SVD, this proposed multiscale learned representation is obtained based on an efficient quadtree decomposition of the learned dictionary and overlapping image patches. The proposed framework provides an alternative to pre-defined dictionaries such as wavelets, and leads to state-of-the-art results in a number of image and video enhancement and restoration applications. The presentation of the framework here proposed is accompanied by numerous examples demonstrating its practical power.
DTIC
Restoration; Representations; Image Processing; Video Communication

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20100018974 Georgetown Univ., Washington, DC USA
Guiding Neuronal Growth in Tissues with Light
Urbach, Jeffrey; Feb 27, 2010; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-07-1-0130
Report No.(s): AD-A518603; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Control over axonal trajectories is a critical component of engineering nerve regeneration and reconnection after injury and is essential for engineering specific connections in vitro neural networks. Neuronal networks interfaced with microelectrode arrays represent a promising class of cell-based biosensors because of their sensitivity to a broad range of neuroactive and toxic substances, but no satisfactory techniques exist for engineering interconnections between neurons or patterning neurons on sensing sites. A variety of approaches have been employed to guide extending axons but almost all have been employed on two dimensional or nearly two dimensional environments. Evidence from a wide range of systems shows that cells are sensitive to the mechanical and structural properties of their surroundings in addition to the biochemical properties. Furthermore, three-dimensional biopolymer matrices provide structural and physiological support that more closely mimics the in vivo environment and would allow for more complex network topologies. It has recently been shown that weak optical forces, generated by an infrared laser spot placed adjacent to the leading edge of the growth cone of an extending axon, enhance growth into the beam focus and result in guided neurite turns, as well as enhanced. The mechanism through which the light modulates the direction of outgrowth is not known, but there is some evidence that the optical forces on the fdopodia play an important role. We investigated the viability of optical neurite guidance in three-dimensions. We analyzed the trajectories of neurites from differentiated PC 12 cells cultured in a 3D matrix of collagen both with and without optical guidance. PC 12 cells are often used as a model system for neural differentiation, and for examining growth cone behavior.
DTIC
Cells (Biology); Infrared Lasers; Nervous System; Neurophysiology

20100018990 Naval Postgraduate School, Monterey, CA USA
Fiducial Marker Detection and Pose Estimation From LIDAR Range Data
Morrison, Richard; Mar 2010; 120 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518637; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Light Detection and Ranging (LIDAR) systems are three dimensional (3D) imaging sensors applied for mapping terrain, measuring structural dimensions, and navigating robots. Pulsed laser rangefinders provide precise range measurements that require an estimate of sensor pose for transformation into world coordinates. Pose information is frequently provided with extrinsic sources such as Global Positioning System (GPS) or an Inertial Measurement Unit (IMU). Unreliable signal availability for GPS in military environments and the high cost of IMUs limit the employment of these extrinsic sources. Determining pose intrinsically by detecting landmarks in the environment within the sensor data is more ideal. Fiducial markers with known geometric dimensions and orientation provide a means of estimating LIDAR pose and registering data. Presented is a method for landmark detection and pose estimation within range data. Cylinder, cone, and sphere geometries are assessed for use as fiducial markers. The detection algorithm extracts geometric features from LIDAR point data and tests for fit to a fiducial marker model. Geometric feature extraction compresses the data set and leads to a potential intrinsic registration method using environment landmarks. The detection accuracy and pose estimation precision are examined with

terrestrial LIDAR range data captured in various outdoor street environments.
DTIC
Detectors; Global Positioning System; Inertial Platforms; Markers; Optical Radar; Pulsed Lasers

20100019016 Naval Postgraduate School, Monterey, CA USA
Power Beaming, Orbital Debris Removal, and Other Space Applications of a Ground Based Free Electron Laser
Wilder, Benjamin; Mar 2010; 182 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518696; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When compared to other laser types, the Free Electron Laser (FEL) provides optimal beam quality for successful atmospheric propagation. Assuming the development and deployment of a mega-watt (MW) class, ground or sea based FEL, this thesis investigates several proposed space applications including power beaming to satellites, the removal of orbital debris, laser illumination of objects within the solar system for scientific study, and interstellar laser illumination for communications. Power beaming simulations are conducted within the Satellite Tool Kit (STK) program to determine the frequency of accesses between a satellite and one or more ground stations for multiple orbital profiles. FEL illumination of orbital debris is modeled to determine the thermal effects on a representative aluminum debris particle. FEL illumination of the Lunar and Martian surfaces is modeled to determine the relative laser and solar spectral intensities at these ranges. FEL illumination at interstellar ranges is modeled and discussed to determine our ability to communicate or detect laser communications over interstellar ranges.
DTIC
Free Electron Lasers; Power Beaming; Space Debris; Technology Utilization

20100019039 Academia Sinica, Shanghai, China
A New Hydrogen-Maser Time and Frequency Standard at Sheshan VLBI Station of Shanghai Observatory
Zhai, Z C; Huang, H X; Lin, C F; Jiang, G X; Luo, W H; Lu, J F; Nov 1989; 9 pp.; In English
Report No.(s): AD-A518804; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new kind of hydrogen-maser time and frequency Standard was installed this September at sheshan 25-meter radio telescope in Shanghai, for very long baseline interferometry (VLBI) experiments. This standard is a readily transportable, rugged and completely integrated frequency standard. The entire system is engineered as a unit, and all electronics were mechanically and electrically integrated with the physical portion into the overall design. This paper describes its design feature and structure as well as the measured results of its performance. Its applications and data in VLBI experiment are also included.
DTIC
Frequency Standards; Hydrogen Masers; Masers; Observatories; Time Measurement; Very Long Base Interferometry

20100019040 Naval Observatory, Washington, DC USA
LASSO Experiment Intercalibration Trip for the Two LASSO Ranging Stations
Gaignebet, J; Hatat, J L; Grudler, P; Klepczynski, W J; McCubbin, L; Wiant, J; Ricklefs, R; Dec 1994; 9 pp.; In English
Report No.(s): AD-A518805; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In order to achieve the accuracy of the LASSO time transfer between OCA, Grasse, France and McDonald Observatory, Texas, USA, an intercalibration of the two Laser Ranging Stations was made. At the same stations, GPS receivers were set up and the GPS to Laser epoch differences were also monitored. In addition to the principle and the results of the measurements, the cause of the difficulties met during the campaign will be described.
DTIC
Calibrating; Intercalibration; Rangefinding

20100019563 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Free-Free Transitions in the Presence of Laser Fields at Very Low Incident Electron Energy
Bhatia, A. K.; Sinha, Chandana; May 25, 2010; 1 pp.; In English; 41st Annual Meeting of the American Physical Society (APS): Division of Atomic, Molecular and Optical Physics, 25-29 May 2010, Houston, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

We study the free-free transition in electron-hydrogenic systems in ground state in presence of an external laser field at very loud incident energies. The laser field is treated classically while the collision dynamics is treated quantum mechanically. The laser field is chosen to be monochromatic, linearly polarized and homogeneous. The incident electron is considered to be

dressed by the laser in a nonperturbative manner by choosing a Volkov wave function for it. The scattering weave function for the electron is solved numerically by taking into account the effect of the electron exchange, short-range as well as of the long-range interactions to get the S and P wave phase shifts while for the higher angular momentum phase shifts the exchange approximation has only been considered. We calculate the laser assisted differential cross sections (LADCS) for the aforesaid free-free transition process for single photon absorption/emission. The laser intensity is chosen to be much less than the atomic field intensity. A strong suppression is noted in the LADCS as compared to the field free (FF) cross sections. Unlike the FF ones, the LADCS exhibit some oscillations having a distinct maximum at a low value of the scattering angle depending on the laser parameters as well as on the incident energies.
Author
Field Strength; Scattering Cross Sections; Electron States; Wave Functions; Lasers

20100019566 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Airborne Lidar Simulator for the Lidar Surface Topography (LIST) Mission
Yu, Anthony W.; Krainak, Michael A.; Abshire, James B.; Cavanaugh, John; Valett, Susan; Ramos-Izquierdo, Luis; [2010]; 4 pp.; In English; 25th International Laser Radar Conference, 5-9 Jul. 2010, St.Petersburg, Russia, Russia; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019566

In 2007, the National Research Council (NRC) completed its first decadal survey for Earth science at the request of NASA, NOAA, and USGS. The Lidar Surface Topography (LIST) mission is one of fifteen missions recommended by NRC, whose primary objectives are to map global topography and vegetation structure at 5 m spatial resolution, and to acquire global surface height mapping within a few years. NASA Goddard conducted an initial mission concept study for the LIST mission in 2007, and developed the initial measurement requirements for the mission.
Author
Optical Radar; Airborne Radar; Earth Sciences; Simulators; Topography; Vegetation

20100019569 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Efficient Swath Mapping Laser Altimetry Demonstration Instrument Incubator Program
Yu, Anthony W.; Krainak, Michael A,; Harding, David J.; Abshire, James B.; Sun, Xiaoli; Cavanaugh, John; Valett, Susan; [2010]; 4 pp.; In English; IGARSS 2010- 2010 IEEE International Geoscience and Remote Sensing Symposium, 23-30 Jul. 2010, Honolulu, HI, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019569

In this paper we will discuss our eighteen-month progress of a three-year Instrument Incubator Program (IIP) funded by NASA Earth Science Technology Office (ESTO) on swath mapping laser altimetry system. This paper will discuss the system approach, enabling technologies and instrument concept for the swath mapping laser altimetry.
Author
Earth Sciences; Laser Altimeters; Topography; Airborne Lasers; Swath (Ship)

20100019695 Virginia Univ., Charlottesville, VA USA
Rapid Repairs: Surface Preparation of Ti-3 Al-2.5V Alloy Tubes by Fiber Laser and Welding
Gupta, Mool C; Kumar, A; Nov 2008; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-05-1-0098
Report No.(s): AD-A518991; 122886/GG10260; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518991

Titanium alloys are used extensively in aerospace applications mainly due to their superior strength to weight ratio. Different grades of titanium alloys are used for different applications. The alloy Ti-3Al-2.5V is used to make seamless tubes, used in hydraulic systems of aircrafts for its excellent cold formability. Welding of these tubes with other components is indispensable for installing hydraulic systems. Normally fusion welding process, namely Gas Tungsten Arc Welding Process (GTAW) is undertaken to join theses components. Different sized tubes are required to be welded with different end fittings. Production of high quality welds in titanium alloys requires meticulous pre-weld surface preparation of the work-pieces. Conventionally such preparation procedures are chemically based, where the entire component is cleaned by chemical etching in toxic chemicals like hydrofluoric acid, nitric acid etc. This process removes some material from the surface along with the contaminant, exposing fresh material for joining purpose. This method is presently adopted by NAVAIR to clean the tubes prior to welding. However these chemicals are hazardous and environmentally malign. Handling of these chemicals, disposal

and safety of individuals is also of concern. The footprint of these cleaning systems is also too large. The main objective of this project is to develop an environmentally friendly compact titanium alloy tube laser cleaning and welding system for NAVAIR use.
DTIC
Aluminum Alloys; Fiber Lasers; Fusion Welding; Gas Tungsten Arc Welding; Laser Welding; Titanium Alloys; Welding

20100019790 Directed Energy Solutions, Colorado Springs, CO USA
High Power 7-GHz Bandwidth External-Cavity Diode Laser Array and Its Use in Optically Pumping Singlet Delta Oxygen
Meng, Lei; Nizamov, Boris; Madasamy, Pratheepan; Brasseur, Jason; Henshaw, Tom; Neumann, David K; Oct 11, 2006; 7 pp.; In English
Contract(s)/Grant(s): FA8650-05-C-6535; Proj-3005
Report No.(s): AD-A519261; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519261
Using a 14-mm thick volume Bragg grating, spectral bandwidth of a diode laser array is narrowed to 7 GHz (FWHM). The total output power is 13.5 W, of which 86% is in the 7-GHz band. With such a narrow bandwidth, it is possible to temperature tune laser frequency across O(2) X(3) Pi - b(1) Sigma(+) absorption line at 763.8 nm, efficiency generating O(2)((1)Delta) molecules.
DTIC
Bandwidth; Bragg Gratings; Diodes; Laser Arrays; Laser Cavities; Oxygen; Semiconductor Lasers

20100019923 University of Central Florida, Orlando, FL USA
Self-Channeling of Femtosecond Laser Pulses for Rapid and Efficient Standoff Detection of Energetic Materials
Baudelet, Matthieu; Richardson, Martin; Sigman, Michael; Jan 2009; 6 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446
Report No.(s): AD-A519463; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Self-channeling properties of high intensity laser pulses are used to extend spectroscopic methods as LIBS to standoff. This work shows the advantages of using selfchanneled femtosecond pulses in Laser-Induced Breakdown Spectroscopy of polymeric micrometer-size thin films in a standoff configuration at 12 meters. We show the possibility of trace analysis on surfaces and the importance of molecular signal as a signature for carbon-based samples.
DTIC
Depth; Detection; Explosives; Laser Spectroscopy; Laser-Induced Breakdown Spectroscopy; Pulsed Lasers; Spectra

20100019930 University of Central Florida, Orlando, FL USA
Thermodynamic and Spectroscopic Properties of Nd:YAG-CO2 Double-Pulse Laser-Induced Iron Plasmas
Weidman, Matthew; Palanco, Santiago; Baudelet, Matthieu; Richardson, Martin C; Jan 2009; 8 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446
Report No.(s): AD-A519477; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Laser-Induced Breakdown Spectroscopy of iron using both Nd:YAG and TEA-CO2 lasers has been investigated to better understand mechanisms of signal enhancement. The signal dependence on the delay between the two laser pulses shows an enhanced signal when the CO2 laser pulse interacts with the sample before the Nd:YAG pulse. Signal kinetics and a simple model of sample heating by the CO2 pulse show that the enhancement during the first 700 ns is due primarily to sample heating. Images of the sample surface after ablation as well as time-integrated pictures of the plasma suggest that particles are ejected from the surface during the first microseconds after the arrival of the CO2 pulse and provide fuel for the subsequent plasma created by the Nd:YAG laser.
DTIC
Carbon Dioxide; Iron; Laser-Induced Breakdown Spectroscopy; Neodymium Lasers; Plasmas (Physics); Pulsed Lasers; Spectroscopy; Thermodynamic Properties; Thermodynamics; YAG Lasers

20100019933 Communications Research Lab., Tokyo, Japan
A Highly Stable Crystal Oscillator Applied to Geodetic VLBI Experiment
Kiuchi, Hitoshi; Amagai, Jun; Dec 1990; 15 pp.; In English
Report No.(s): AD-A519486; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Instead of a hydrogen maser, a carefully selected Crystal oscillator which is phase locked to a Cesium (Cs) frequency

standard for time range of more than 100 seconds is adopted to the time and frequency standard of a geodetic VLBI experiment. The domestic VLBI experiment with 55km baseline using the Crystal oscillator at one end was made in Japan and the obtained error of the baseline vector components were 4cm, and that of the baseline length was 3cm. This system may be operated after only 2 hours warm up. These results coincides with those of conventional geodetic Laser ranging and VLBI using a hydrogen maser within the formal error. A VLBI experiment with over 1000km baselines were carried out successfully from October 1988, and over 11000km baseline bctween Japan and Antarctica was carried out succcssfully in January 1990. DTIC

Crystal Oscillators; Geodesy; Masers; Very Long Base Interferometry

20100019939 Academia Sinica, Shanghai, China

A Hydrogen Maser with Cavity Auto-Tuner for Timekeeping

Lin, C F; He, J W; Zhai, Z C; Dec 1991; 9 pp.; In English

Report No.(s): AD-A519500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A hydrogen maser frequency standard for timekeeping has been worked at Shanghai Observatory. The maser employs a fast cavity auto-tuner, which can detect and compensate the frequency drift of the high-Q resonant cavity with a short time constant by means of a signal injection method, so the long term frequency stability of the maser standard was greatly improved. This paper describes the cavity auto-tuning system and some maser data obtained from the atomic time comparison. DTIC

Cavities; Frequency Standards; Hydrogen Masers; Masers; Tuners

20100019941 Naval Observatory, Washington, DC USA

Performance of Soviet and U.S. Hydrogen Masers

Uljanov, Adolf A; Demidov, Nikolai A; Mattison, Edward M; Vessot, Robert F; Allan, David W; Winkler, Gernot M; Dec 1990; 16 pp.; In English

Report No.(s): AD-A519502; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The frequencies of Soviet- and U.S.-built hydrogen masers located at the Smithsonian Astrophysical Observatory and at the USA Naval Observatory (USNO) were compared with each other and, via GPS common-view measurements, with three primary frequency-reference scales. The best masers were found to have fractional frequency stabilities as low as 6x10(-16) for averaging times of approximately 10(4) s. Members of the USNO maser ensemble provided frequency prediction better than 1x10(-14) for periods up to a few weeks. The frequency residuals of these masers, after removal of frequency drift and rate of change of drift, had stabilities of a few parts in 10(-15), with several masers achieving residual stabilities well below 1x10(-15) for intervals from 10(5)s to 2x10(6)s. The fractional frequency drifts of the 13 masers studied, relative to the primary reference standards, ranged from -0.2x10(-15)/day to +9.6 x 10(-15)/day.
DTIC

Hydrogen Masers; Masers

20100020017 National Inst. of Standards and Technology, Gaithersburg, MD USA

Kinetic Modeling Study of the Laser-Induced Plasma Plume of Cyclotrimethylenetrinitramine (RDX)

Babushok, V I; DeLucia, Jr, F C; Dagdigian, P J; Gottfried, J L; Munson, C A; Nusca, M J; Miziolek, A W; Jan 2007; 9 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0446; W911QA-05-P-0901

Report No.(s): AD-A519685; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A kinetic model of a laser-induced breakdown spectroscopy (LIBS) plume of cyclotrimethylenetrinitramine (RDX) was developed for the analysis of processes responsible for the LIBS signature of explosives. Air and argon were considered as buffer gases. The model includes a set of processes involving ion chemistry, as well as excitation, ionization, and other processes affecting neutral and ion species. Modeling results show that the overall reaction process can be considered a two-stage process. The first stage corresponds to a fast approach to a quasi-stationary state, while the second stage corresponds to the change of quasi-stationary species concentrations due to the change in temperature. As a result of the two-stage process, the initial mechanism of explosive decomposition is not important in determining its signature in the LIBS measurement time window (1-30 (mu)s). The main processes responsible for generation of excited states for the LIBS emission are electron-excitation impact processes. A mechanism for the appearance of a double peak of the C2 species concentration in the

RDX plasma plume was suggested. Double-peak behavior of the C2 species was previously experimentally observed during laser ablation of graphite.
DTIC
Explosives; Kinetics; Plasmas (Physics); Plumes; RDX

20100020022 Academia Sinica, Shanghai, China
A Kind of Small Hydrogen Maser for Time-Keeping
Zhai, Z C; Lin, C F; He, J W; Huang, H X; Lu, J F; Dec 1991; 8 pp.; In English
Report No.(s): AD-A519697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A kind of small hydrogen maser standard for timekeeping is being developed at Shanghai Observatory. The maser employs a cylindrical capacitively loaded cavity construction, resulting in significant size and weight reduction compared to a traditional hydrogen maser. The Q of the compact cavity is electronically enhanced by a suitable positive feedback into the cavity to enable sustained maser oscillation. The long-term stability of the maser is improved by a cavity frequency stabilization servo system. This paper describes the design and development of the maser, as well as photographs of the new maser system during the construction phase.
DTIC
Hydrogen; Hydrogen Masers; Masers; Time Measurement

20100020025 Laboratoire de Spectrometrie Ionique et Moleculaire, Villeurbanne, France
Correlation Between Early-Stage Expansion and Spectral Emission of a Nanosecond Laser-Induced Plasma from Organic Material
Baudelet, Matthieu; Boueri, Myriam; Yu, Jin; Mao, Samuel S; Mao, Xianglei; Russo, Richard E; Jan 2008; 9 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446
Report No.(s): AD-A519717; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Laser-Induced Breakdown Spectroscopy (LIBS) has been used since 40 years on typical samples such as metals, alloys, rocks. Detection of organic hazards or analysis of biological compounds under atmospheric pressure with LIBS represents a new challenge. For this purpose, we need better understandings of the physico-chemical properties of the plasma in atmosphere and their influences on the LIBS signal. As a model sample of organic materials, Nylon 6-6 has been studied under nanosecond ablation at different wavelengths (1064 nm and 266 nm) and energies (from 1 to 5 mJ) in order to observe the influence of these parameters. Shadowgraph technique is used to image the plasma at its early stage of expansion (0 to 40 ns). Time-resolved LIBS signal is recorded for longer times (50 ns to 5 microseconds). In the infrared regime, the expansion of the plume is faster along the laser axis, perpendicular to the sample surface. On the contrary, for UV ablation, the expansion of the plume is quite isotropic. We can also observe different regimes of expansion due to Laser-Supported Detonation Waves (LSDW) above 3 mJ in the UV regime. In particular, these observations provide us ideas to understand the kinetics of the CN emission in the LIBS signal. In the IR regime, a formation of CN due to carbon present in the sample and nitrogen in the air via the reaction 2C + N2 [proceeds to] 2CN can be observed. In the UV regime, the direct ablation of CN bonds is clearly seen but other effects like screening and recombination due to LSDW have also been observed.
DTIC
Ablation; Laser Plasmas; Laser Spectroscopy; Laser-Induced Breakdown Spectroscopy; Organic Materials; Plasmas (Physics); Shadowgraph Photography; Spectral Emission

20100020027 California Univ., Berkeley, CA USA
Theory Analysis of Wavelength Dependence of Laser-Induced Phase Explosion of Silicon
Lu, Quanming; Mao, Samuel S; Mao, Xianglei; Russo, Richard E; Jan 2008; 8 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0446; DE-AC02-05CH11231
Report No.(s): AD-A519719; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wavelength dependence of laser ablation of silicon was investigated with nanosecond ultraviolet, visible, and infrared laser pulses in the irradiance range from 3 x 10(exp 10) to 1 x 10(exp 12) W/cm2. For 266 and 532 nm laser pulses, the depth of laser-produced crater shows a dramatic increase at a laser irradiance threshold of approximately 2 x 10(exp 10) and 4 x 10(exp 11) W/cm2 respectively, above which, large micron-sized particulates were observed to eject from the target about 300 - 400 ns after the laser pulse. In contrast, for 1064 nm pulse, this dramatic increase was not observed. The underlying mechanism for the observed threshold phenomenon is presented in this study, which can be attributed to the thermal diffusion and subsequent explosive boiling after the completion of the interaction between the nanosecond laser pulse and silicon. Based

on our delayed phase explosive model, the ablation depths were calculated for different wavelengths and compared to experimental results. Plasma shielding during laser irradiation was included in the model, which plays a key role to the coupling of laser energy to the irradiated material.
DTIC
Ablation; Boiling; Explosions; Infrared Lasers; Laser Applications; Laser Plasmas; Plasmas (Physics); Shielding; Silicon

20100020031 Engineering Conferences International, Inc., New York, NY USA
International Workshop on Microplasmas (5th)
Korpics, Kevin M; Apr 14, 2010; 117 pp.; In English
Contract(s)/Grant(s): FA9550-09-1-0099
Report No.(s): AD-A519733; 09-AG; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This was scientifically a very successful conference attended by about 90 people (about 15 graduate students) almost equally divided between attendees from USA (21), Asia (31), and Europe (28). In all, about 12 countries were represented by about 90% academics, with the rest from industry. The 4.5-day conference had 42-1/2 hour talks (most speakers used most of their 30 minutes, cutting discussion) and two poster sessions with a total of about 49 posters. Microplasmas is a growing field because of the medical applications.
DTIC
Laser Plasmas; Microplasmas; Plasma Jets

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20100019164 NASA Glenn Research Center, Cleveland, OH, USA
Pressure Decay Testing Methodology for Quantifying Leak Rates of Full-Scale Docking System Seals
Dunlap, Patrick H., Jr.; Daniels, Christopher C.; Wasowski, Janice L.; Garafolo, Nicholas G.; Penney, Nicholas; Steinetz, Bruce M.; April 2010; 23 pp.; In English; 45th Joint Propulsion Conference and Exhibit, 2-5 Aug. 2009, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 644423.06.31.04,01.03.22
Report No.(s): NASA/TM-2010-216244; AIAA Paper 2009-5319; E-17231; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019164

NASA is developing a new docking system to support future space exploration missions to low-Earth orbit and the Moon. This system, called the Low Impact Docking System, is a mechanism designed to connect the Orion Crew Exploration Vehicle to the International Space Station, the lunar lander (Altair), and other future Constellation Project vehicles. NASA Glenn Research Center is playing a key role in developing the main interface seal for this docking system. This seal will be relatively large with an outside diameter in the range of 54 to 58 in. (137 to 147 cm). As part of this effort, a new test apparatus has been designed, fabricated, and installed to measure leak rates of candidate full-scale seals under simulated thermal, vacuum, and engagement conditions. Using this test apparatus, a pressure decay testing and data processing methodology has been developed to quantify full-scale seal leak rates. Tests performed on untreated 54 in. diameter seals at room temperature in a fully compressed state resulted in leak rates lower than the requirement of less than 0.0025 lbm, air per day (0.0011 kg/day).
Author
Crew Exploration Vehicle; Leakage; Spacecraft Docking; Space Exploration; International Space Station; Low Earth Orbits

20100019499 Society of Automotive Engineers, Inc., Warrendale, PA, USA
High Efficiency with Future Alcohol Fuels in a Stoichiometric Medium-Duty Spark Ignition Engine
Brusstar, M. J.; Gray, C. L.; October 29, 2007; 14 pp.; In English
Report No.(s): PB2010-109161; EPA-2007-01-3993; No Copyright; Avail.: National Technical Information Service (NTIS)

Ethanol and methanol are both attractive SI fuels for achieving high efficiency at near gas-engine costs. Better-than-diesel efficiency with PFI-SI alcohol engines. Stoichiometric operation with a standard three-way catalyst. Alcohol fuels offer

potentially ultra-low greenhouse gas emissions when produced from biomass. Specific CO2 emissions: metric for comparing the effectiveness of engines operating on various fuels.
NTIS
Alcohols; Fuels; Internal Combustion Engines; Spark Ignition; Stoichiometry

20100019501 RTI International, Research Triangle Park, NC, USA
Regulatory Impact Analysis (RIA) for Existing Stationary Compression Ignition Engines NESHAP
Sinha, P.; Depro, B.; Braun, F.; February 2010; 147 pp.; In English
Contract(s)/Grant(s): EP-D-06-003
Report No.(s): PB2010-107409; No Copyright; Avail.: National Technical Information Service (NTIS)

EPA estimates that complying with the final RICE rule will have an annualized cost of approximately $373 million per year (2008 dollars) in the year of full implementation of the rule (2013). Using these costs, EPA estimates in its economic impact analysis that the NESHAP will have limited impacts on the industries affected and their consumers. Using sales data obtained for affected small entities in an analysis of the impacts of this proposal on small entities, EPA expects that the NESHAP will not result in a SISNOSE (significant economic impacts for a substantial number of small entities). EPA also does not expect significant adverse energy impacts based on Executive Order 13211, an Executive Order that requires analysis of energy impacts for rules such as this one that are economically significant under Executive Order 12866.
NTIS
Diesel Engines; Transportation

20100019737 Cable and Wireless Public Ltd. Co., London, UK
The Cable & Wireless Approach to Network Synchronization
Calvert, Robert D; Dec 1990; 9 pp.; In English
Report No.(s): AD-A519096; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519096

This paper presents the philosophy adopted by Cable and Wireless for the synchronization of its worldwide network. It identifies the architectures of some of the clock systems already deployed and how network synchronization has been implemented at selected locations. This includes some innovative designs as the network spans both first and third world countries with a combination of North American and European hierarchy equipment. Different parts of the global network are linked together by a combination of terrestrial microwave, submarine cable and satellite technology. The paper also addresses the impact of synchronization on Intelsat IDR operation and the restoration of submarine cable systems. The paper does not attempt to identify details of all the clock systems deployed by Cable and Wireless and its subsidiary companies world-wide, rather a snapshot of some of these systems is presented.
DTIC
Clocks; Communication Networks; Synchronism

20100020154 Environmental Protection Agency, Washington, DC, USA
Nonroad Spark-Ignition Engine Emission Deterioration Factors
December 2005; 16 pp.; In English
Report No.(s): PB2010-108650; EPA-420-R-05-023; No Copyright; Avail.: CASI: A03, Hardcopy

This report addresses the emission deterioration rates for spark-ignition engines used in the final NONROAD2005 model. The specific deterioration inputs used in NONROAD and their basis will be addressed for land-based spark-ignition engines at or below 25 horsepower, land-based spark-ignition engines over 25 horsepower, and recreational marine spark-ignition engines using gasoline. Deterioration is also addressed for land-based liquid petroleum gas (LPG) and compressed natural gas engines (CNG). Deterioration inputs for compression-ignition (diesel) engines are addressed in the report, Exhaust Emission Factors for Nonroad Engine Modeling - Compression Ignition (NR-009c). The EPA welcomes comments and suggestions concerning our approach to modeling nonroad engine emissions deterioration.
NTIS
Deterioration; Internal Combustion Engines; Spark Ignition

20100020156
Commercial Marine Emission Inventory Development. Final Report
July 2002; 163 pp.; In English
Report No.(s): PB2010-108648; EPA-420-R-02-019; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, emissions were estimated for vessels propelled by Category 3 engines (those with cylinder displacements

above 30 liters). Chapter 1 reviews the emissions data available for these types of engines and provides estimates of average emission factors to be used in later emission estimates. Chapter 2 details which ports were considered similar and matched to each of several ports for which detailed port call data was available from earlier EPA work in order to estimate emissions for all ports. Chapter 3 provides a description of how the emission estimates near and at US ports were performed and summarizes results for all ports combined. Chapter 4 describes and summarizes emissions estimates for these type of vessels operating in US waters outside the area covered by the Chapter 3 estimates. Chapter 5 estimates future year emissions at US ports. Chapter 6 provides a sensitivity analysis for a number of assumptions and estimates used in the compilation of the Chapter 3 results.
NTIS
Air Pollution; Exhaust Emission; Gas Turbine Engines; Inventories; Marine Propulsion; Pollution Control

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20100020162 NASA Johnson Space Center, Houston, TX, USA
Nondestructive Crack Detection in a Fuel System Component
Koshti, Ajay; Ruffino, Norman; Wincheski, Russell; Prosser, William; Winfree, William; Russell, Richard; Bryson, Craig; Devries, Robert; Engel, James; Landy, James; May 10, 2010; 28 pp.; In English; 2010 Aircraft Airworthiness and Sustainment Conference, 10-13 May 2010, Austin, TX, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20150; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020162

The presentation examines the background and objective of nondestructive crack detection, flow control valve assembly and poppet post flight evaluation, poppet properties. magnetic property characterization of lab data, NDE, eddy current inspection, simulation, eddy current criteria, poppet cycle testing and NDE criteria, and the use of ultrasonic surface wave for crack detection.
CASI
Eddy Currents; Nondestructive Tests; Cracks; Fault Detection

20100020205 NASA White Sands Test Facility, NM, USA
40-in. OMS Kevlar(Registered Trademark) COPV S/N 007 Stress Rupture Test NDE
Saulsberry, Regor; Greene, Nate; Forth, Scott; Leifeste, Mark; Gallus, Tim; Yoder, Tommy; Keddy, Chris; Mandaras, Eric; Wincheski, Buzz; Williams, Philip; Russell, Richard; Eldridge, Jeff; May 10, 2010; 25 pp.; In English; 2010 Aircraft Airworthiness and Sustainment Conference, 10-13 May 2010, Austin, TX, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20602; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020205

The presentation examines pretest nondestructive evaluation (NDE), including external/internal visual inspection, raman spectroscopy, laser shearography, and laser profilometry; real-time NDE including eddy current, acoustic emission (AE), and real-time portable raman spectroscopy; and AE application to carbon/epoxy composite overwrapped pressure vessels.
CASI
Composite Wrapping; Epoxy Matrix Composites; Nondestructive Tests; Pressure Vessels; Acoustic Emission

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20100019006 Naval Postgraduate School, Monterey, CA USA
Defining the Role and Responsibility of the Fire Service Within Homeland Security
Jones, Dennis D; Mar 2010; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many fire service providers (FSPs) do not adequately address homeland security. While some FSPs in the USA have

dedicated homeland security divisions or operational practices, the majority do not. The current roles and responsibilities of most FSPs appear to be broad and vague, as there are no overall adopted best practices for developing homeland security response procedures and/or practices. While the majority of FSPs deliver fire suppression and emergency medical services, the majority of FSPs have not broadened their service delivery models to address the preventative, emergent and recovery phases of service delivery within homeland security. While there are no widely accepted practices, regulations or standards addressing FSPs and their expectations within homeland security, it is possible to create a structure upon which FSPs may build. This document will demonstrate the importance of cultural acceptance of homeland security services, which will lead to effective planning and preparedness as well as appropriate resourcing and training practices. From these components FSPs, regardless of their size, jurisdiction served, geographic location, jurisdictional target threat assessments, budgetary resources and staffing matrixes will be able to create a structure that will allow them to provide effective and efficient homeland security services.
DTIC
Fires; Security

20100019151 NASA Langley Research Center, Hampton, VA, USA
Forces Associated with Nonlinear Nonholonomic Constraint Equations
Roithmayr, Carlos M.; Hodges, Dewey H.; [2010]; 28 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 992858.13.07.02
Report No.(s): LF99-5423; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019151

In previous work, a comprehensive, consistent, and concise method has been formulated for identifying a set of forces needed to constrain the behavior of a mechanical system modeled as a set of particles and rigid bodies. In this paper it is shown that the method is applicable to motion constraints described by nonholonomic equations that are inherently nonlinear in velocity. Two new approaches are presented for deriving equations governing motion of a system subject to such constraints. By using partial accelerations instead of the partial velocities normally employed with Kane's method, it is possible to form dynamical equations that either do or do not contain evidence of the constraint forces, depending on the analyst's interests. Author
Nonlinear Equations; Nonholonomic Equations; Motion; Rigid Structures

20100019666 General Accounting Office, Washington, DC USA
Operation Iraqi Freedom: Actions Needed to Facilitate the Efficient Drawdown of U.S. Forces and Equipment from Iraq
Solis, William M; Balloon, Vincent; Bumgarner, John; Cavanaugh, Carolynn; Coffey, Carole; DiNapoli, Timothy; Fish, Laurier; Fullerton, Walker; LoFaro, Guy; Marchand, Greg; Norman, Emily; Pogacnik, Jason; Pross, Mark; Schmitt, David; Weissman, Cheryl; Winterlin, Gerald; Woolwine, Gwyneth; Apr 2010; 53 pp.; In English
Report No.(s): AD-A518890; GAO-10-376; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518890

Several DOD organizations have issued coordinated plans for the execution of the drawdown, but DOD has yet to fully plan for requirements for contracted services needed during the drawdown. Since our September 2008 report, DOD created new organizations to oversee, synchronize, and ensure unity of effort during the drawdown and established goals and metrics for measuring progress. To date, DOD reports that its drawdown efforts have exceeded its goals. For example, as of January 2010, DOD reported that it exceeded its target figure for withdrawing rolling stock in Iraq?which includes wheeled and tracked combat vehicles, some construction equipment, and trailers?by over 2,600 pieces. However, a large amount of personnel, equipment, and bases remain to be drawn down. In addition, although DOD took some steps to plan for contracted services, limited operational planning for contracted support has challenged its ability to identify the full range of its needs for contracted services to support the drawdown; existing processes may not allow sufficient time for all contracted services needed to be put on contract in a responsible manner; and there exists a lack of clarity regarding the roles and responsibilities of various contract validation review boards. Without addressing these issues, DOD risks not having the right contracted services in place to meet drawdown timelines, which may lead to inefficient and wasteful practices as the drawdown continues.
DTIC
Construction; International Relations; Iraq; Organizations

20100020160 Army Engineer Research and Development Center, Vicksburg, MS USA

Boundary Connection Behavior and Connection Design for Retrofitted Unreinforced Masonry Walls Subjected to Blast Loads (Preprint)

Hoemann, John; Davidson, James; Dinan, Robert; Bewick, Bryan; February 2010; 14 pp.; In English

Contract(s)/Grant(s): FA4819-09-C-0032; Proj-4918

Report No.(s): AD-A519043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519043

Over the past decade, extensive experimental and analytical research has been conducted on the behavior and resistance of unreinforced masonry (URM) walls retrofitted with methods for increasing ductility. This includes numerous experiments conducted by the Airbase Technologies Division of the Air Force Research Laboratory (AFRL). These retrofit materials varied from soft elastomeric coatings to very stiff composites and metal sheets. Some retrofit materials were strongly bonded to the masonry wall, which resulted in an integrated system response, while others were not bonded to the masonry and the membrane simply acted as a barrier that prevented secondary fragmentation from entering the occupied space. Previous research programs by AFRL and others have focused on the development of the retrofit materials, with the predominant exploratory measure focusing on the maximum inward transverse displacement. However, little emphasis was placed on the real behavior of the boundaries of these systems and the proper and efficient design of connections. This paper discusses an appropriate analytical methodology for the design of retrofit connections to resist impulse loads due to blast. In addition, typical support conditions for URM walls, and the shear, flexure and friction interaction of blast-impulse-loaded retrofitted URM walls at their support boundaries are discussed. The ideas and conclusions presented herein are based on component-level static testing, full scale explosion arena testing, and high fidelity finite element modeling.

DTIC

Blast Loads; Boundaries; Masonry; Retrofitting; Walls

20100020260 Army Construction Engineering Research Lab., Champaign, IL USA

Membrane and Flashing Condition Indexes for Modified Bitumen Roofs: Inspection and Distress Manual

Bailey, David M.; March 2010; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): MIPR8H0DFG7068

Report No.(s): AD-A518899; ERDC/CERL-TR-010-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518899

The U.S. Army is currently responsible for maintaining millions of square feet of modified bitumen roofing on its facilities. Modified bitumen roofing systems share a number of characteristics with other common systems, but they also employ certain unique materials and therefore have their own specialized distress and degradation mechanisms. Dedicated inspection guidance and condition index calculation methods are required to quantify the condition of an installation's modified bitumen roofing assets in order to make the best use of Army maintenance and repair resources. This document was developed to provide roof inspectors with a standard reference for performing inspections, and calculating a flashing condition index (FCI) and membrane condition index (MCI) for use in facility maintenance management activities. It represents a new implementation of the widely used ROOFER Sustainment Management System for roofing asset management.

DTIC

Bitumens; Degradation; Inspection; Membranes; Roofs

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20100019308 NASA Langley Research Center, Hampton, VA, USA

Methane on Mars: Thermodynamic Equilibrium and Photochemical Calculations

Levine, J. S.; Summers, M. E.; Ewell, M.; April 26, 2010; 2 pp.; In English; Astrobiology Science Conference 2010. Evolution and Life: Surviving Catastrophes and Extremes on Earth and Beyond, 26-29 Apr. 2010, League City, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 736466.01.09.07.05.15

Report No.(s): NF1676L-9951; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019308

The detection of methane (CH4) in the atmosphere of Mars by Mars Express and Earth-based spectroscopy is very

surprising, very puzzling, and very intriguing. On Earth, about 90% of atmospheric ozone is produced by living systems. A major question concerning methane on Mars is its origin - biological or geological. Thermodynamic equilibrium calculations indicated that methane cannot be produced by atmospheric chemical/photochemical reactions. Thermodynamic equilibrium calculations for three gases, methane, ammonia (NH3) and nitrous oxide (N2O) in the Earth s atmosphere are summarized in Table 1. The calculations indicate that these three gases should not exist in the Earth s atmosphere. Yet they do, with methane, ammonia and nitrous oxide enhanced 139, 50 and 12 orders of magnitude above their calculated thermodynamic equilibrium concentration due to the impact of life! Thermodynamic equilibrium calculations have been performed for the same three gases in the atmosphere of Mars based on the assumed composition of the Mars atmosphere shown in Table 2. The calculated thermodynamic equilibrium concentrations of the same three gases in the atmosphere of Mars is shown in Table 3. Clearly, based on thermodynamic equilibrium calculations, methane should not be present in the atmosphere of Mars, but it is in concentrations approaching 30 ppbv from three distinct regions on Mars.

Author

Methane; Atmospheric Composition; Mars Atmosphere; Photochemical Reactions; Thermodynamic Equilibrium; Mars Express; Chemical Reactions; Mars Surface; Ammonia; Nitrous Oxides

43
EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth features, phenomena and resources by aircraft, balloon, rocket, and spacecraft; analysis of remote sensing data and imagery; development of remote sensing products; photogrammetry; and aerial photography. For related instrumentation see *35 Instrumentation and Photography*.

20100018719 Naval Research Lab., Washington, DC USA

WindSat Polarmetric View of Greenland

Li, L; Gaiser, P; Jan 2006; 4 pp.; In English

Report No.(s): AD-A517967; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517967

WindSat is the first spaceborne microwave polarimetric radiometer that measures all four elements of the Stokes vector, the brightness temperatures at vertical and horizontal polarizations (TV and TH), and the real and imaginary parts of the cross-correlation of the vertical and horizontal polarization known as the third and fourth Stokes parameters (TU and TF). WindSat was developed by NRL and had been in operation since January 2003. The polarimetric signatures of the third and fourth Stokes measurements are mostly related to the asymmetric structures of the ocean-wind-driven surface roughness. Prior to the launch of WindSat, it was a common belief that land polarimetric signatures at satellite footprint scales would be below the instrument noise level and would not carry any useful geophysical information. However, postlaunch data processing reveals significant land signals in the TU and TF, particularly over Greenland and the Antarctic ice sheets, which are the most environmentally sensitive Earth media, playing a significant role in global sea level and climate changes. Understanding this polarimetric signature, uniquely afforded by WindSat, and its relation with the snow properties and microstructures will have a profound impact on climate study.

DTIC

Greenland; Polarimetry; Snow

20100018880 Army War Coll., Carlisle Barracks, PA USA

The Strategic Minerals Problem: Our Domestic Options

King, Alwyn H; Jan 1982; 10 pp.; In English

Report No.(s): AD-A518291; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As we progress into the 1980s and beyond, increasing world demand for high-grade mineral deposits, and their corresponding depletion, can be expected to intensify competition for the world's strategic materials. A growing militance among the less-developed supplier nations in their quest for a new world economic order, and the simultaneous exercise of Soviet power and influence in the continuing East-West struggle, will further disturb the increasingly competitive environment and heighten its potential for generating international conflict. The precise effect of these developments on US national security interests is difficult to foretell; the continuing high level of US dependence on certain foreign mineral supplies is, however, a cause for concern. Today critical materials availability poses no significant problems for Army readiness and combat effectiveness. The best time to develop an awareness of potential problems, however, is before they become crises. Timely planning and appropriate action are essential for all elements of the Department of Defense, as well as other

government agencies, if problems related to strategic minerals availability are going to be controlled and a strong US strategic minerals position is going to be regained and maintained.
DTIC
Minerals; Strategic Materials; Supplying

20100019155 NASA, Washington, DC, USA
CEOS Contributions to Informing Energy Management and Policy Decision Making Using Space-Based Earth Observations
Eckman, Richard S.; November 30, 2009; 9 pp.; In English; International Conference on Applied Energy, 21-23 Apr. 2010, Singapore, Singapore; Original contains color illustrations
Contract(s)/Grant(s): WBS 281945.02.03.02.08
Report No.(s): NF1676L-9908; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019155

Earth observations are playing an increasingly significant role in informing decision making in the energy sector. In renewable energy applications, space-based observations now routinely augment sparse ground-based observations used as input for renewable energy resource assessment applications. As one of the nine Group on Earth Observations (GEO) societal benefit areas, the enhancement of management and policy decision making in the energy sector is receiving attention in activities conducted by the Committee on Earth Observation Satellites (CEOS). CEOS has become the 'space arm' for the implementation of the Global Earth Observation System of Systems (GEOSS) vision. It is directly supporting the space-based, near-term tasks articulated in the GEO three-year work plan. This paper describes a coordinated program of demonstration projects conducted by CEOS member agencies and partners to utilize Earth observations to enhance energy management end-user decision support systems. I discuss the importance of engagement with stakeholders and understanding their decision support needs in successfully increasing the uptake of Earth observation products for societal benefit. Several case studies are presented, demonstrating the importance of providing data sets in formats and units familiar and immediately usable by decision makers. These projects show the utility of Earth observations to enhance renewable energy resource assessment in the developing world, forecast space-weather impacts on the power grid, and improve energy efficiency in the built environment.
Author
Earth Observations (From Space); Renewable Energy; Remote Sensing; Energy Policy; Artificial Satellites; Decision Support Systems; Decision Making; Energy Conservation

20100019252 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Transmittance Measurement of a Heliostat Facility used in the Preflight Radiometric Calibration of Earth-Observing Sensors
Czapla-Myers, J.; Thome, K.; Anderson, N.; McCorkel, J.; Leisso, N.; Good, W.; Collins, S.; August 2, 2009; 8 pp.; In English; SPIE Optics and Photonics 2009, 2-6 Aug. 2009, San Diego, CA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 228493; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019252

Ball Aerospace and Technologies Corporation in Boulder, Colorado, has developed a heliostat facility that will be used to determine the preflight radiometric calibration of Earth-observing sensors that operate in the solar-reflective regime. While automatically tracking the Sun, the heliostat directs the solar beam inside a thermal vacuum chamber, where the sensor under test resides. The main advantage to using the Sun as the illumination source for preflight radiometric calibration is because it will also be the source of illumination when the sensor is in flight. This minimizes errors in the pre- and post-launch calibration due to spectral mismatches. It also allows the instrument under test to operate at irradiance values similar to those on orbit. The Remote Sensing Group at the University of Arizona measured the transmittance of the heliostat facility using three methods, the first of which is a relative measurement made using a hyperspectral portable spectroradiometer and well-calibrated reference panel. The second method is also a relative measurement, and uses a 12-channel automated solar radiometer. The final method is an absolute measurement using a hyperspectral spectroradiometer and reference panel combination, where the spectroradiometer is calibrated on site using a solar-radiation-based calibration.
Author
Aerospace Engineering; Transmittance; Heliostats; Remote Sensing; Solar Radiation; Vacuum Chambers; Calibrating; Radiometers

20100019255 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Radiometric Characterization of Hyperspectral Imagers using Multispectral Sensors

McCorkel, Joel; Kurt, Thome; Leisso, Nathan; Anderson, Nikolaus; Czapla-Myers, Jeff; August 2, 2009; 6 pp.; In English; SPIE Optics and Photonics 2009, 2-6 Aug. 2009, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019255

The Remote Sensing Group (RSG) at the University of Arizona has a long history of using ground-based test sites for the calibration of airborne and satellite based sensors. Often, ground-truth measurements at these test sites are not always successful due to weather and funding availability. Therefore, RSG has also automated ground instrument approaches and cross-calibration methods to verify the radiometric calibration of a sensor. The goal in the cross-calibration method is to transfer the calibration of a well-known sensor to that of a different sensor, This work studies the feasibility of determining the radiometric calibration of a hyperspectral imager using multispectral a imagery. The work relies on the Moderate Resolution Imaging Spectroradiometer (M0DIS) as a reference for the hyperspectral sensor Hyperion. Test sites used for comparisons are Railroad Valley in Nevada and a portion of the Libyan Desert in North Africa. Hyperion bands are compared to MODIS by band averaging Hyperion's high spectral resolution data with the relative spectral response of M0DlS. The results compare cross-calibration scenarios that differ in image acquisition coincidence, test site used for the calibration, and reference sensor. Cross-calibration results are presented that show agreement between the use of coincident and non-coincident image pairs within 2% in most brands as well as similar agreement between results that employ the different MODIS sensors as a reference.

Author

Imaging Spectrometers; High Resolution; Remote Sensing; Radiometers; MODIS (Radiometry); Satellite Observation; Hyperion; Satellite Instruments

20100019475 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Terra, Aqua, and Aura Direct Broadcast - Providing Earth Science Data for Realtime Applications

Kelly, Angelita C.; Coronado, Patrick L.; Case, Warren F.; Franklin, Ameilia; [2010]; 3 pp.; In English; IGARSS 2010, 25-30 Jul. 2010, Honolulu, HI, USA; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019475

The need for realtime data to aid in disaster management and monitoring has been clearly demonstrated for the past several years, e.g., during the tsunami in Indonesia in 2004, the hurricane Katrina in 2005, fires, etc. Users want (and often require) the means to get earth observation data for operational regional use as soon as they are generated by satellites. This is especially true for events that can cause loss of human life and/or property. To meet this need, NASA's Earth Observing System (EOS) satellites, Terra and Aqua, provide realtime data useful to disaster management teams. This paper describes the satellites, their Direct Broadcast (DB) capabilities, the data uses, what it takes to deploy a DB ground station, and the future of the DB.

Derived from text

Aqua Spacecraft; Broadcasting; Earth Sciences; Ground Stations; Real Time Operation; MODIS (Radiometry)

20100019509 NASA Stennis Space Center, Stennis Space Center, MS, USA

Potential of VIIRS Time Series Data for Aiding the USDA Forest Service Early Warning System for Forest Health Threats: A Gypsy Moth Defoliation Case Study

Spruce, Joseph P.; Ryan, Robert E.; Smoot, James; Kuper, Phillip; Prados, Donald; Russell, Jeffrey; Ross, Kenton; Gasser, Gerald; Sader, Steven; McKellip, Rodney; September 20, 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T; NNS07AA29T

Report No.(s): SSTI-2220-0127; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019509

This report details one of three experiments performed during FY 2007 for the NASA RPC (Rapid Prototyping Capability) at Stennis Space Center. This RPC experiment assesses the potential of VIIRS (Visible/Infrared Imager/Radiometer Suite) and MODIS (Moderate Resolution Imaging Spectroradiometer) data for detecting and monitoring forest defoliation from the non-native Eurasian gypsy moth (Lymantria dispar). The intent of the RPC experiment was to assess the degree to which VIIRS data can provide forest disturbance monitoring information as an input to a forest threat EWS (Early Warning System) as compared to the level of information that can be obtained from MODIS data. The USDA Forest Service (USFS) plans to use MODIS products for generating broad-scaled, regional monitoring products as input to an EWS for forest health threat assessment. NASA SSC is helping the USFS to evaluate and integrate currently available satellite remote sensing technologies

and data products for the EWS, including the use of MODIS products for regional monitoring of forest disturbance. Gypsy moth defoliation of the mid-Appalachian highland region was selected as a case study. Gypsy moth is one of eight major forest insect threats listed in the Healthy Forest Restoration Act (HFRA) of 2003; the gypsy moth threatens eastern U.S. hardwood forests, which are also a concern highlighted in the HFRA of 2003. This region was selected for the project because extensive gypsy moth defoliation occurred there over multiple years during the MODIS operational period. This RPC experiment is relevant to several nationally important mapping applications, including agricultural efficiency, coastal management, ecological forecasting, disaster management, and carbon management. In this experiment, MODIS data and VIIRS data simulated from MODIS were assessed for their ability to contribute broad, regional geospatial information on gypsy moth defoliation. Landsat and ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer) data were used to assess the quality of gypsy moth defoliation mapping products derived from MODIS data and from simulated VIIRS data. The project focused on use of data from MODIS Terra as opposed to MODIS Aqua mainly because only MODIS Terra data was collected during 2000 and 2001-years with comparatively high amounts of gypsy moth defoliation within the study area. The project assessed the quality of VIIRS data simulation products. Hyperion data was employed to assess the quality of MODIS-based VIIRS simulation datasets using image correlation analysis techniques. The ART (Application Research Toolbox) software was used for data simulation. Correlation analysis between MODIS-simulated VIIRS data and Hyperion-simulated VIIRS data for red, NIR (near-infrared), and NDVI (Normalized Difference Vegetation Index) image data products collectively indicate that useful, effective VIIRS simulations can be produced using Hyperion and MODIS data sources. The r(exp 2) for red, NIR, and NDVI products were 0.56, 0.63, and 0.62, respectively, indicating a moderately high correlation between the 2 data sources. Temporal decorrelation from different data acquisition times and image misregistration may have lowered correlation results. The RPC experiment also generated MODIS-based time series data products using the TSPT (Time Series Product Tool) software. Time series of simulated VIIRS NDVI products were produced at approximately 400-meter resolution GSD (Ground Sampling Distance) at nadir for comparison to MODIS NDVI products at either 250- or 500-meter GSD. The project also computed MODIS (MOD02) NDMI (Normalized Difference Moisture Index) products at 500-meter GSD for comparison to NDVI-based products. For each year during 2000-2006, MODIS and VIIRS (simulated from MOD02) time series were computed during the peak gypsy moth defoliation time frame in the study area (approximately June 10 through July 27). Gypsy moth defoliation mapping products from simated VIIRS and MOD02 time series were produced using multiple methods, including image classification and change detection via image differencing. The latter enabled an automated defoliation detection product computed using percent change in maximum NDVI for a peak defoliation period during 2001 compared to maximum NDVI across the entire 2000-2006 time frame. Final gypsy moth defoliation mapping products were assessed for accuracy using randomly sampled locations found on available geospatial reference data (Landsat and ASTER data in conjunction with defoliation map data from the USFS). Extensive gypsy moth defoliation patches were evident on screen displays of multitemporal color composites derived from MODIS data and from simulated VIIRS vegetation index data. Such defoliation was particularly evident for 2001, although widespread denuded forests were also seen for 2000 and 2003. These visualizations were validated using aforementioned reference data. Defoliation patches were visible on displays of MODIS-based NDVI and NDMI data. The viewing of apparent defoliation patches on all of these products necessitated adoption of a specialized temporal data processing method (e.g., maximum NDVI during the peak defoliation time frame). The frequency of cloud cover necessitated this approach. Multitemporal simulated VIIRS and MODIS Terra data both produced effective general classifications of defoliated forest versus other land cover. For 2001, the MOD02-simulated VIIRS 400-meter NDVI classification produced a similar yet slightly lower overall accuracy (87.28 percent with 0.72 Kappa) than the MOD02 250-meter NDVI classification (88.44 percent with 0.75 Kappa). The MOD13 250-meter NDVI classification had a lower overall accuracy (79.13 percent) and a much lower Kappa (0.46). The report discusses accuracy assessment results in much more detail, comparing overall classification and individual class accuracy statistics for simulated VIIRS 400-meter NDVI, MOD02 250-meter NDVI, MOD02-500 meter NDVI, MOD13 250-meter NDVI, and MOD02 500-meter NDMI classifications. Automated defoliation detection products from simulated VIIRS and MOD02 data for 2001 also yielded similar, relatively high overall classification accuracy (85.55 percent for the VIIRS 400-meter NDVI versus 87.28 percent for the MOD02 250-meter NDVI). In contrast, the USFS aerial sketch map of gypsy moth defoliation showed a lower overall classification accuracy at 73.64 percent. The overall classification Kappa values were also similar for the VIIRS (approximately 0.67 Kappa) versus the MOD02 (approximately 0.72 Kappa) automated defoliation detection product, which were much higher than the values exhibited by the USFS sketch map product (overall Kappa of approximately 0.47). The report provides additional details on the accuracy of automated gypsy moth defoliation detection products compared with USFS sketch maps. The results suggest that VIIRS data can be effectively simulated from MODIS data and that VIIRS data will produce gypsy moth defoliation mapping products that are similar to MODIS-based products. The results of the RPC experiment indicate that VIIRS and MODIS data products have good potential for integration into the forest threat EWS. The accuracy assessment was performed only for 2001 because of time constraints and a relative scarcity of cloud-free Landsat

and ASTER data for the peak defoliation period of the other years in the 2000-2006 time series. Additional work should be performed to assess the accuracy of gypsy moth defoliation detection products for additional years.The study area (mid-Appalachian highlands) and application (gypsy moth forest defoliation) are not necessarily representative of all forested regions and of all forest threat disturbance agents. Additional work should be performed on other inland and coastal regions as well as for other major forest threats.
Author
Defoliation; MODIS (Radiometry); Forests; Early Warning Systems; Imaging Techniques; Data Simulation

20100019742 Florida Univ., Gainesville, FL USA
A Fluid Mud Transport Model in Multi-dimensions
Hsu, Tian-Jian; Traykovski, Peter A; Jan 2008; 9 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0494
Report No.(s): AD-A519111; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519111

The long term goal is to develop a robust multi-phase, multi-class numerical modeling framework for both cohesive and non-cohesive sediment transport in the fluvial and coastal environments. The objectives of the present study focus on extending a fluid mud model for boundary-layer-driven and gravity-driven transport (Hsu et al. 2007) with several new capabilities. Specifically, the objectives are to: * Carry out model development and model-data comparisons with laboratory/field observed fluid mud processes, specifically in conjunction with new MURI initiative for understanding wavemud interaction. * Extend the existing fluid mud model with a flocculation module and a bed module to enable direct modeling on consolidation/fluidization. Extend the model to multi-dimensional for various coastal and estuarine applications. * In conjunction to NOPP-Community Sediment Transport Model initiative, the fluid model is utilized to provide parameterizations for wave-boundary-layer-scale transport processes.
DTIC
Mud; Ocean Models

20100019932 Bolt, Beranek, and Newman, Inc., Arlington, VA USA
Development of Advanced Propagation Models and Application to the Study of Impulsive Infrasonic Events
Norris, David E; Bhattacharyya, Joydeep; Whitaker, Rodney W; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-C-0135
Report No.(s): AD-A519483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Research advances have been made in the areas of advanced model development, ground truth (GT) event studies, and model validation. They are focused on understanding the driving mechanisms that affect measured waveforms, and quantifying the prediction performance of new modeling capabilities. High fidelity predictions of infrasonic waveforms properties, including travel time and amplitude, improve source localization. These advances also support discrimination between various infrasonic impulsive events. New additions have been made to the GT database. These additions mainly focus on events that are directly related to nuclear weapons testing: near-surface nuclear explosion (NE), underground nuclear explosion (UNE), and high-explosives (HE) events. They are well-calibrated GT events and significant domain knowledge resides with our Los Alamos National Laboratory (LANL) colleagues. Digital waveforms from the HE events at range of 1.5 to 60 km have been acquired and will be used to explore the boundaries between propagation regimes near the infrasound source. New propagation modeling capabilities include a ray model that incorporates the effects of diffraction, PE/TDPE models that incorporate small-scale atmospheric variability, and PE/TDPE models that account for terrain. Detailed model comparisons studies have been complete for both the 1988 Henderson explosion and White Sands Missile Range (WSMR) I, II, and III rocket experiments.
DTIC
Infrasonic Frequencies; Models

20100019981 Office of the Engineer, Far East Command, Tokyo, Japan
Military Geology of Saipan, Mariana Islands. Volume 1: Introduction and Engineering Aspects
Cloud, Jr , Preston E; Schmidt, Robert G; Burke, Harold W; Nicol, Allen H; Davis, Dan A; Zarza, Ray E; McCracken, Ralph J; Jan 1955; 173 pp.; In English
Report No.(s): AD-A519590; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The military geology of Saipan, Mariana Islands, is one of a series of reports resulting in geological and soil surveys

conducted under the Pacific Geological Mapping Program which was established as a part of the Corps of Engineers Pot Hostilities Mapping Program. The purpose of these programs are two-fold: the first is to collect scientific information through field study of major islands in the Pacific; the second is to publish it in a form so that it is useable by the US Armed Forces and Civil Administrators working on assignments in those islands. Volume I of the Military Geology of Saipan is composed of observations made in the field, physical testing of materials, and evaluation of the geologic and soils materials in terms of their engineering properties. Mapping was done in the field on aerial photographs, scale 1:10,000 and 1:25,000. Both the geological and soils mapping were done in the period September 1948 to July 1949.
DTIC
Geology; Islands; Pacific Ocean; Soils

20100020012 Boston Univ., Boston, MA USA
Predicting the Evolution of Tidal Channels in Muddy Coastlines
Fagherazzi, Sergio; Jan 2007; 6 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0664
Report No.(s): AD-A519672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To develop methods to predict the long-term evolution of tidal channels in muddy coastlines as a function of sediment availability, hydrodynamics, and climate change. To develop predictive, high-resolution models for the hydrodynamics and sediment dynamics of tidal channels in muddy coastal environments To quantify the relationships between sediment supply to tidal channels, resuspension of fine material in the shelf by wind waves, and sediment input from major rivers. Measure the supply of sediments to a Louisiana salt marsh and the short-term sediment deposition on the marsh surface. Apply, test, and validate a high resolution hydrodynamic-sediment transport model in a Louisiana marsh and determine the short-term evolution of the tidal channels and the erosion deposition patterns on the marsh platform. Integrate the short-term results of the high resolution numerical model in already developed longterm models of tidal channel evolution. Link the transport of sediments to salt marshes via tidal channels to the resuspension of fine sediments in the adjacent shelf. Compare the results of the MURI project Mechanisms of Fluid Mud Interactions under Waves to measurements of sediment concentration in a nearby marsh channel. Share and merge the model and results with those of the MURI Research Group.
DTIC
Coasts; Hydrodynamics; Mud; Predictions; Sediments; Shorelines; Tides

20100020034 Weapon Systems Technology Information Analysis Center, Alexandria, VA USA
DoD Collaboration the Wiki Way. WSTIAC Quarterly, Volume 8, Number 4
Oct 1, 2008; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519736; WSTIAC-V8-N4; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This issue of the WSTIAC Quarterly features articles on Advances in Airborne Geophysical Systems for Ordnance mapping and Detection and a news article FCS Active Protection System in 'Top 50' Inventions. Included the WSTIAC Calendar of Events and the Directors Corner. Details on several Training Courses sponsored by WSTIAC are also included in this issue.
DTIC
Ammunition; Education; Geophysics; Mapping; Ordnance

20100020136 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Remote Sensing of the Absorption Coefficients and Chlorophyll a Concentration in the U.S. Southern Middle Atlantic Bight from SeaWiFS and MODIS-Aqua
Pan, Xiaoju; Mannino, Antonio; Russ, Mary E.; Hooker, Stanford B.; September 2008; 54 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNX08AO25G; NA03NOS4730220; Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020136

At present, satellite remote sensing of coastal water quality and constituent concentration is subject to large errors as compared to the capability of satellite sensors in oceanic waters. In this study, field measurements collected on a series of cruises within U.S. southern Middle Atlantic Bight (SMAB) were applied to improve retrievals of satellite ocean color products in order to examine the factors that regulate the bio-optical properties within the continental shelf waters of the SMAB. The first objective was to develop improvements in satellite retrievals of absorption coefficients of phytoplankton (a(sub ph)), colored dissolved organic matter (CDOM) (a(sub g)), non-pigmented particles (a(sub d)), and non-pigmented

particles plus CDOM (a(sub dg)), and chlorophyll a concentration ([Chl_a]). Several algorithms were compared to derive constituent absorption coefficients from remote sensing reflectance (R(sub rs)) ratios. The validation match-ups showed that the mean absolute percent differences (MAPD) were typically less than 35%, although higher errors were found for a(sub d) retrievals. Seasonal and spatial variability of satellite-derived absorption coefficients and [Chl_a] was apparent and consistent with field data. CDOM is a major contributor to the bio-optical properties of the SMAB, accounting for 35-70% of total light absorption by particles plus CDOM at 443 nm, as compared to 30-45% for phytoplankton and 0-20% for non-pigmented particles. The overestimation of [Chl_a] from the operational satellite algorithms may be attributed to the strong CDOM absorption in this region. River discharge is important in controlling the bio-optical environment, but cannot explain all of the regional and seasonal variability of biogeochemical constituents in the SMAB.
Author
Remote Sensing; Aqua Spacecraft; Chlorophylls; Sea-Viewing Wide Field-of-View Sensor; Bays (Topographic Features); Atlantic Ocean; Absorptivity

20100020180 National Oceanic and Atmospheric Administration, Boulder, CO, USA
UV Absorption Cross Sections of Nitrous Oxide (N2O) and Carbon Tetrachloride (CCl4) Between 210 and 350 K and the Atmospheric Implications
Carlon, Nabilah Rontu; Papanastasiou, Dimitrios K.; Fleming, Eric L.; Jackman, Charles H.; Newman, Paul A.; Burkholder, James B.; April 29, 2010; 26 pp.; In English; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020180

Absorption cross sections of nitrous oxide (N2O) and carbon tetrachloride (CCl4) are reported at five atomic UV lines (184.95, 202.548, 206.200, 213.857, and 228.8 nm) at 27 temperatures in the range 210-350 K. In addition, UV absorption spectra of CCl4 are reported between 200-235 nm as a function of temperature (225-350 K). The results from this work are critically compared with results from earlier studies. For N2O, the present results are in good agreement with the current JPL recommendation enabling a reduction in the estimated uncertainty in the N2O atmospheric photolysis rate. For CCl4, the present cross section results are systematically greater than the current recommendation at the reduced temperatures most relevant to stratospheric photolysis. The new cross sections result in a 5-7% increase in the modeled CCl4 photolysis loss, and a slight decrease in the stratospheric lifetime, from 51 to 50 years, for present day conditions. The corresponding changes in modeled inorganic chlorine and ozone in the stratosphere are quite small. A CCl4 cross section parameterization for use in 37 atmospheric model calculations is presented.
Author
Atmospheric Models; Absorption Cross Sections; Carbon Tetrachloride; Nitrous Oxides; Ultraviolet Absorption

20100020265 Lawrence Livermore National Lab., Livermore, CA USA; California Inst. of Tech., Pasadena, CA, USA
Advanced Waveform Simulation for Seismic Monitoring Events
Helmberger, Don V.; Tromp, Jeroen; Rodgers, Arthur J.; September 2007; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-FC52-06NA27319
Report No.(s): AD-A518885; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518885

Comprehensive nuclear-test-ban monitoring in terms of location and discrimination has progressed significantly in recent years. However, the characterization of sources and the estimation of low yields remains a particular challenge. As the recent Korean shot demonstrated, we can probably expect to have a small set of teleseismic, far-regional and high-frequency regional data to analyze in estimating the yield of an event. Since stacking helps to bring signals out of the noise, it becomes useful to conduct comparable analyses on neighboring events, earthquakes in this case. If these auxiliary events have accurate moments and source descriptions, we have a means of directly comparing effective source strengths. Although we will rely on modeling codes, 1D, 2D, and 3D, we will also apply a broadband calibration procedure to use longer periods (P 5 s) of waveform data to calibrate short-period (P between 0.5 to 2 Hz) and high-frequency (P between 2 to 10 Hz) as path-specific station corrections from well-known regional sources. We have expanded our basic cut-and-paste (CAP) methodology to include not only timing shifts but also amplitude (f) corrections at recording sites. The name of this method was derived from source inversions that allow timing shifts between waveform segments (or cutting the seismogram up and re-assembling) to correct for crustal variation. For convenience, we will refer to these f-dependent refinements as CAP+ for (short period, SP) and CAP++ for still higher frequency. These methods allow the retrieval of source parameters using only P-waveforms where radiation patterns are obvious as demonstrated in this report and are well suited for explosion P-wave data. The method is

easily extended to all distances because it uses Green's function although there may be some changes required in t* to adjust for offsets between local vs. teleseismic distances.
DTIC
Computerized Simulation; Earthquakes; Green's Functions; Seismic Waves; Seismology; Simulation; Waveforms

20100020293 Los Alamos National Lab., NM USA
Geophysical Imaging of Asia and Siberia: Tomography for Seismic Velocity, Upper Mantle Gradient, Lg Attenuation, and Joint Inversion of Surface Wave Dispersion, Receiver Functions and Satellite Gravity Data
Rowe, Charlotte A.; Phillips, William S.; Maceira, Monica; Begnaud, Michael L.; Steck, Lee K.; Yang, Xiaoning; Lucero, Christian L.; Hartse, Hans E.; Stead, Richard J.; Mackey, Kevin G.; Fujita, Kazuya; Ammon, Charles J.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007, pp. 256-265; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA
Contract(s)/Grant(s): DE-AC52-06NA25396
Report No.(s): AD-A519480; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our geophysical modeling efforts have focused on a variety of special studies. We continue to develop models for Eastern Russia using the Michigan State Siberia database, for which we have expanded over previous Pn velocity tomography by also inverting Lg amplitudes for a regional attenuation study, and a preliminary tomographic image of Pg travel times in Eurasia, including the Siberia region. Both Lg attenuation and Pg velocity tomographic studies illuminate features consistent with known aspects of Siberian and Russian Far East tectonics and are consistent with features derived in our earlier Pn study. Lg attenuation studies will help to improve our understanding of phase amplitudes for calibration across eastern Russia, and an improved Pg model will allow us to better calibrate travel times in the area when secondary phase arrivals are needed for event location. We are exploring the effects of upper mantle velocity gradients on the two-dimensional (2-D) tomographic image for P-waves that travel through the upper mantle for regional-distance source-receiver pairs (2.5 to 18 degrees). By adding an upper mantle gradient term to the inversion for 2-D varying Pn velocity and crustal time terms, we are able to map a 2-D varying upper mantle gradient, based on travel times from high-quality event locations. Lateral gradients in the upper mantle across central and eastern Eurasia vary from -0.001 s(-1) to 0.003 s(-1). High gradients appear to be associated with regions of tectonic convergence, both continental and oceanic, as well as stable cratonic regions. Variance reduction is 63% with respect to Pn tomography without gradients. An improved mapping not only of Pn velocities but also of the upper mantle gradients that influence the travel times for this phase is important for ongoing efforts to improve event location throughout central and eastern Asia.
DTIC
Asia; Geophysics; Gravitation; Imaging Techniques; Inversions; Receivers; Surface Waves; Tomography; Velocity Distribution; Wave Dispersion

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ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20100018399 National Taiwan Univ., Taipei, Taiwan, Province of China
An Intelligent System of Catalyst Layer Deposition for Proton Exchange Membrane Fuel Cell
Wang, En-Jung James; Lee, Min-Fan Ricky; Ko, Cheng-Hao Kevin; Journal of the Chinese Institute of Engineers, Volume 33, No. 1. Special Issue: Micro- and Nano-Fabrication Technologies; January 2010, pp. 89-98; In English; See also 20100018398; Copyright; Avail.: Other Sources

Reliability and durability are two main factors influencing fuel cell commercialization. The membrane electrode assembly (MEA) is the key component of the proton exchange membrane (or polymer electrolyte membrane) (PEM) fuel cell. The performance of MEA is primarily impacted by the structure of the catalytic layer. Various methods for coating catalyst material onto the membrane and the gas diffusion layer (GDL) have been surveyed. Various parameters to be controlled to optimize the catalytic layer characteristic have been discussed. There is no direct mathematical model available correlating the two most important quality factor, the thickness and evenness, and the machine control parameter, traveling speed of the spraying nozzle and the distance between two paths. High-level intelligent control architecture for the autospray process is proposed in this

paper to automatically generate the appropriate spray trajectory and speed in real-time for the low-level controller to achieve a homogeneous catalyst layer coating (evenness and thickness). The method proposed in this paper provide a non computational high-level linguistic control without use of an explicit mathematical model while the coupling dynamic exist. Author

Coating; Deposition; Electrolytic Cells; Membranes; Protons; Fuel Cells; Electrocatalysts

20100018741 Naval Research Lab., Washington, DC USA

Aerobic Miniature Microbial Fuel Cells

Ringeisen, B R; Biffinger, J C; Pietron, J; Ray, R; Little, B; Jan 2008; 3 pp.; In English

Report No.(s): AD-A518015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518015

Distributed autonomous sensor (DAS) networks will require sustainable energy-scavenging power sources for persistent surveillance applications. Ideally, these power sources will scale with the sensor size (micro/nanoelectromechanical) to enable covert deployment and a small power budget. Based on their ability to sustain power production for years while scavenging energy from a variety of environments and nutrients, microbial fuel cells (MFCs) are a viable solution to power water-borne DAS networks. However, to date, nearly all MFCs are large and bulky (100 cu cm to cu m), making them significantly larger than many sensors and communication packages. Researchers in the NRL Chemistry and Oceanography Divisions have recently developed the first high power density miniature MFC (mini-MFC). The mini-MFC has a 2.0 sq cm cross-section and a 1.2 cu cm volume, making it orders of magnitude smaller than traditional MFCs. Additionally, the mini-MFC is designed to maximize current collection and proton diffusion to the cathode, enabling unprecedented power per area (3 W/sq m) and volume (500 W/cu m) when using graphite felt electrodes and Shewanella oneidensis cultured under micro-aerophilic conditions. These power densities are sustained when S. oneidensis biofilms on the anode are used with acellular media. Previous to this work, mixed consortia of bacteria with the ability to utilize electron donors efficiently needed to be used to produce current densities above 50 W/cu m. The mini-MFC design and size create a unique device that enhances power production per volume when compared to any other MFC design in the literature. These results are an indication that further size reductions may further increase power density and enable microbial energy scavengers to power DAS networks for Navy-relevant applications in the littoral water column.

DTIC

Aerobes; Donor Materials; Electrodes; Electron Transfer; Fuel Cells; Fuels; Microorganisms; Miniaturization

20100018794 Naval Postgraduate School, Monterey, CA USA

Oil and Conflict: Fatal Attraction? A Correlational Examination of Oil Resources and Armed Conflict

McGinley, James E; Dec 2009; 9 pp.; In English

Report No.(s): AD-A518144; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518144

A concern over the potential for resource competition to serve as a driver for conflict has established the need to more fully examine the relationship between energy resources and conflict. This exploratory correlational study examined the relationship between oil resources, armed conflict and stability. The ability of abundant oil resources to attract conflict and the ability of oil resource deficits to compel participation in armed conflict abroad were both explored. Since instability may be a precursor to conflict, the relationship between oil resources and stability was also examined. Overall, no statistically significant relationships were found between oil resources and either armed conflict or stability. However, stability was significantly related to both hosting and participating in conflict, although with opposite polarities. Results indicate that in today's global environment oil resources alone may be insufficient as an indicator of energy's contribution to active, armed conflict.

DTIC

Oils; Reservoirs; Resources

20100018938 Bonneville Power Administration, Vancouver, WA USA

Bonneville Power Administration Timing System

Martin, Kenneth E; Dec 1995; 11 pp.; In English

Report No.(s): AD-A518488; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Bonneville Power Administration (BPA) is a power marketing agency for the U.S. Federal government. It was established to market power from the federal dams being constructed on the Columbia River and has evolved into the major

bulk power supplier in the Pacific Northwest. BPA sells power produced at Federal generating facilities, coordinates the Columbia river hydro system, and transmits power for other utilities. Time is an integral part of BPA's operational systems. Generation and power transfers are planned in advance. Utilities coordinate with each other by making these adjustments on a timed schedule. Price varies with demand, so billing is based on time. Outages for maintenance are scheduled to assure they do not interrupt reliable power delivery. Disturbance records are aligned with recorded timetags for analysis and comparison with related information. Advanced applications like traveling wave fault location and real-time phase measurement require continuous timing with high precision. Most of BPA is served by a Central Time System (CTS) at the Dittmer Control Center near Portland, OR. This system keeps time locally and supplies time to both the control center systems and field locations via a microwave system. It is kept synchronized to national standard time and coordinated with interconnected utilities. It is the official BPA time. There are a few BPA applications which are not served by the CTS.
DTIC
Dams; Electric Generators; Electric Power Plants; Global Positioning System; Project Management

20100018996 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Evaluation of Compressed Work Schedules and Their Impact on Electricity Use
Archambault-Miliner, Ryan R; Mar 2010; 123 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518646; AFIT/GCA/ENV/10-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As the largest energy consumer in the USA, the Department of Defense must consider all fiscally responsible means to improve energy efficiency. Budgetary and environmental concerns are a catalyst for numerous initiatives designed to reduce energy consumption. Congressional mandates outline the rate at which agencies must reduce facility energy use. In this study, Monte Carlo simulation was used to compare electricity consumption, costs, and emissions produced under 5-day work weeks versus compressed work schedules in two buildings at Wright-Patterson Air Force Base in Ohio. The research provides energy managers a template for evaluating compressed work schedules as a means to improve energy efficiency. The study found that the relationship between the amount of electricity consumed on duty and non-duty days determines the effectiveness of compressed work schedules in improving energy efficiency. Electricity use in the test facilities on non-duty days was 72 to 90 percent of duty-day consumption. The resulting difference in electricity consumption, costs, and emissions was less than one percent when implementing compressed work schedules. Compressed work schedules can incrementally improve energy efficiency for facilities with lower levels of electricity consumption on non-duty days. Therefore, energy managers will achieve greater gains in energy efficiency by improving the facilities themselves rather than focusing on the use of the buildings.
DTIC
Air Pollution; Costs; Electricity; Energy Conservation; Energy Consumption; Military Air Facilities; Schedules; Scheduling

20100019680 Library of Congress, Washington, DC USA
Department of Defense Facilities Energy Conservation Policies and Spending
Andrews, Anthony; Feb 19, 2009; 29 pp.; In English
Report No.(s): AD-A518959; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518959

In the early 1970s, Congress began mandating reductions in energy consumed by federal agencies; primarily by improving building efficiency, and reducing fossil fuel use. Early legislation mandated a 10% reduction in federal building energy and a recent Executive Order mandates a 30% further reduction by 2015. President-elect Obama has included the goal of improving public building energy efficiency in his administration's economic recovery plan. This report reviews energy conservation legislation and Executive Orders that apply to the Department of Defense, directives and instructions to the military departments and agencies on implementing the legislation and orders, Defense spending on facility energy over the last decade, annual Defense appropriations that fund energy-conservation improvements, and Defense energy conservation investments. In FY2007, Defense spending on energy to operate its facilities reached almost $3.5 billion. In the last decade, Congress has appropriated $443 million in Defense energy conservation projects, and the value of contracts to install energy savings improvements has exceeded $2.8 billion. While the Defense Department has reduced its energy consumption, its energy spending increased due to higher energy prices. Congress continues to look at furthering energy efficiency improvements in aging Defense facilities and buildings as a means to rein in energy consumption and spending.
DTIC
Costs; Defense Program; Energy Conservation; Law (Jurisprudence); Policies

20100020177 Office of Inspector General, Arlington, VA USA

Review of Task Force Shield Programs

Furbish, Glenn; Reyes, Nelson; Stanka, Michael; Venner, Jason; White, Ralph; McDermott, Joseph T.; April 28, 2006; 45 pp.; In English

Report No.(s): AD-A519042; SIGIR-06-009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519042

Task Force Shield was established in September 2003 with the mission of building Iraq's capacity to protect its oil and electrical infrastructure. Iraq's oil and electrical infrastructure includes approximately 340 key installations, 7,000 kilometers of oil pipeline, and 14,000 kilometers of electricity transmission line. To protect this infrastructure, Task Force Shield was to oversee the training and operation of an Iraqi Oil Protection Force (OPF) of 14,400 guards for the Iraqi Ministry of Oil and the training and equipping of 6,000 Iraqi Electrical Power Security Service (EPSS) guards for the Iraqi Ministry of Electricity. We determined that about $147 million was spent from the Development Fund for Iraq and the Iraq Relief and Reconstruction Fund on these efforts between August 2003 and September 2005. Records for these programs are maintained by the Iraq Reconstruction Management Office (IRMO), the Joint Contracting Command-Iraq/Afghanistan (JCC-I/A), and other U.S. agencies. This report addresses the U.S.-led effort, implemented by Task Force Shield, from September 2003 through April 2005, to build the capacity of the Iraqi Government to protect its oil and electrical infrastructure. Specifically, this report addresses the extent to which: U.S. agencies in charge of reconstruction activities provided a clear management structure for Task Force Shield, Task Force Shield trained and equipped a competent Oil Protection Force, and Task Force Shield trained and equipped a competent Electrical Power Security Service As part of our efforts to perform this review in accordance with government audit standards, we must report that during the course of this review there was a lack of available program, financial, and contract records and U.S. officials in Baghdad with first-hand knowledge of the Task Force Shield program.

DTIC

Iraq; Oil Fields

20100020276 Army Tank-Automotive Research and Development Command, Warren, MI USA

Energy Storage Requirements and Challenges for Ground Vehicles

Dial, Boyd; Olszanski, Ted; March 18, 2010; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519664; TARDEC-20622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

These briefing charts discuss TARDEC's energy storage team mission, vehicle requirements for energy storage and Army ground vehicle power and energy challenges.

DTIC

Energy Storage; Mission Planning

20100020299 Naval Postgraduate School, Monterey, CA USA

Security of Energy: The Conflict after Next? Strategic Insights, Volume 7, Issue 1

Hamon, David W.; Dupuy, Arnold C.; February 2008; 10 pp.; In English

Report No.(s): AD-A519723; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The vulnerability of the industrialized world's energy infrastructure has been an international security concern for the last several decades. In recent years energy security has taken added significance as the need for petroleum products has grown, and the sources of these products have shifted further from the Organization for Economic Co-Operation and Development (OECD) states, to unreliable or unstable regions, primarily in the Former Soviet Union (FSU) and the Greater Middle East (GME). Indeed, the last few years have only highlighted this vulnerability, such as Russia's varied disputes with her neighbors, militant activities in Nigeria and the general upswing in Islamic radicalism and hostility toward the West. The next hot war or global conflict of cold war proportions may be over energy and the broader impact that industry has on the international economy. What is emerging in many countries is Oil Nationalism, in which national control of energy is the manifestation of national strength and the source of political power. Quite often, revenues from the nationalized oil companies (NOCs) are lavished on social programs of questionable value, while substantive economic or infrastructural reforms are ignored. Talk of strengthening the Gas Exporting Countries Forum, is also causing concern among energy importing nations. Natural gas can be supplanted by other sources of energy, so an exporters cartel will not have the same global impact as OPEC. Nevertheless, it is clear that gas importers, which are predominantly OECD members, are uncomfortable with the prospect of another, mostly non-OECD, cartel. Not all the concern is with carbon-based energy resources. The renewed interest in nuclear technology has the potential to generate clean and cheap energy; though, even when dedicated to civilian use, it can be converted to highly enriched, or weapons grade, uranium (HEU).

DTIC

International Relations; Petroleum Products; Security

20100020316 Army Aviation and Missile Command, Redstone Arsenal, AL USA
Structural Health Monitoring of Strategically Tuned Absolutely Resilient Structures (STARS)
Marotta, Stephen A.; Ooi, Teng K.; Gilbert, John A.; January 2010; 7 pp.; In English
Report No.(s): AD-A519390; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Strategically Tuned Absolutely Resilient Structures (STARS) are being designed to store potential energy in the form of elastic deformation that can be released in a controlled fashion as work or kinetic energy. This paper outlines steps being taken to monitor the structural health of STARS by making modifications to a Remote Readiness Asset Prognostic and Diagnostic System (RRAPDS). The latter is being developed by the U.S. Army Aviation and Missile Command Research, Development and Engineering Center (AMRDEC)/U.S. Army Tank Automotive and Armaments Command, Armaments Research, Development and Engineering Center (TARDEC) to monitor health/condition and deliver advanced diagnostics/prognostics while an asset (i.e., missile) is tactically deployed, in storage, and/or being transported. As an example of this application, it is described how and why accelerometers are being redesigned to quantify the dynamic performance of ConQuest, Team UAH's entry in the 2004 ASCE/MBT National Concrete Canoe Competition.
DTIC
Cements; Detectors; Elastic Properties; Graphite; Health; Kinetic Energy; Reliability

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20100018374 Texas Southern Univ., Houston, TX, USA
Guidebook on Forecasting Traffic Characteristics for Air Quality Analyses
Yu, Lei; Qiao, Fengxiang; Oey, Hong; August 2002; 33 pp.; In English
Contract(s)/Grant(s): Proj, 0-4142
Report No.(s): PB2010-106838; No Copyright; Avail.: National Technical Information Service (NTIS)

In this research, techniques for estimating and forecasting the three critical mobile source emission related travel indicators were developed. The three indicators are vehicle age distribution, mileage accumulation rates by vehicle type, and VMT related variables. As for estimating vehicle age distribution, two types of models were developed. Model Type I (MT I) models the number of vehicles for the particular vehicle type in particular age, and then transfers the results to project the future age distribution. Model Type II (MT II) models the future age distribution directly. Both model types contain a family of linear models, nonlinear models and time series models. Based on a certain kind of criteria, the best model can be chosen from the two model families. Examples for the eight counties in Houston-Galveston Area Council (HGAC) area and in El Paso area are used for examination.
NTIS
Air Quality; Handbooks; Traffic

20100018377 Portland State Univ., OR, USA; Oregon Univ. Health Sciences Center, Portland, OR, USA; National Climate Center, Beijing, China; Academia Sinica, Nanjing, China
Emissions Of Greenhouse Gases from Rice Agriculture. Final Report
Kjalil, M. A. K.; January 2009; 23 pp.; In English
Contract(s)/Grant(s): DE-FG02-04-ER63913
Report No.(s): DE2010-959124; No Copyright; Avail.: National Technical Information Service (NTIS)

This project produced detailed data on the processes that affect methane and nitrous oxide emissions from rice agriculture and their inter-relationships. It defines the shifting roles and potential future of these gases in causing global warming and the benefits and tradeoffs of reducing emissions.
NTIS
Agriculture; Greenhouse Effect; Methane; Nitrous Oxides; Rice

20100018380 WPI, Richmond, VA, USA
Nuclear Ship SAVANNAH - Radiological and Non-Radiological Spaces Characterization Survey Report. Rev. 1
February 02, 2006; 736 pp.; In English
Contract(s)/Grant(s): DTMA1C05013
Report No.(s): PB2010-107063; No Copyright; Avail.: CASI: A99, Hardcopy

The N/S SAVANNAH (NSS) Characterization Project is intended to provide the Maritime Administration (MARAD) with

a profile of radiological and non-radiological contaminants on the ship in radiological spaces. The scope of work was to perform a radiological and environmental hazard characterization program of the radiological spaces to document the location and extent of radiological and environmentally hazardous materials within these spaces preceding the decommissioning effort. In addition, a number of smears and samples were taken in non-radiological spaces to facilitate future analyses. The information obtained from this project will enable MARAD to develop appropriate decommissioning strategies and to estimate associated costs.
NTIS
Characterization; Contaminants; Grasslands; Hazardous Materials; Marine Transportation; Radiology; Ships; Surveys

20100018499 Environmental Protection Agency, Washington, DC USA
Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008
April 15, 2010; 463 pp.; In English
Report No.(s): PB2010-108043; EPA/430/R-10/006; No Copyright; Avail.: CASI: A20, Hardcopy

The USA Environmental Protection Agency (EPA) prepares the official U.S. Inventory of Greenhouse Gas Emissions and Sinks to comply with existing commitments under the United Nations Framework Convention on Climate Change (UNFCCC). Under decision 3/CP.5 of the UNFCCC Conference of the Parties, national inventories for UNFCCC Annex I parties should be provided to the UNFCCC Secretariat each year by April 15. In an effort to engage the public and researchers across the country, the EPA has instituted an annual public review and comment process for this document. This chapter summarizes the latest information on U.S. anthropogenic greenhouse gas emission trends from 1990 through 2008.
NTIS
Climate Change; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Inventories

20100018505 National Academy of Sciences - National Research Council, Washington, DC, USA
Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 8
January 2009; 464 pp.; In English
Contract(s)/Grant(s): W81K04-06-D-0023; EP-W-09-007
Report No.(s): PB2010-107923; No Copyright; Avail.: CASI: A20, Hardcopy

This report is the eighth volume in the series Acute Exposure Guideline Levels for Selected Airborne Chemicals. In the Bhopal disaster of 1984, approximately 2,000 residents living near a chemical plant were killed and 20,000 more suffered irreversible damage to their eyes and lungs following accidental release of methyl isocyanate. The toll was particularly high because the community had little idea what chemicals were being used at the plant, how dangerous they might be, or what steps to take in an emergency. This tragedy served to focus international attention on the need for governments to identify hazardous substances and to assist local communities in planning how to deal with emergency exposures.
NTIS
Air Pollution; Chemical Engineering; Exposure; Industries; Poisons; Toxicity

20100018510 Environmental Protection Agency, Research Triangle Park, NC USA
Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2001, Annual Report
Hall, E. S.; Dimmick, F.; Tikvart, J.; February 2010; 164 pp.; In English
Contract(s)/Grant(s): EPA-RW75922615-01-0; CDC-07FED63951
Report No.(s): PB2010-107591; EPA/600/R-10/016; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O(sub 3) and PM(sub 2.5) concentrations throughout the continental USA during the 2001 calendar year. HBM estimates provide the spatial and temporal variance of O(sub 3) and PM(sub 2.5), allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical fusion of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.
NTIS
Air Quality; Bayes Theorem; Estimates; Mathematical Models

20100018525 Government Accountability Office, Washington, DC, USA

Vehicle Fuel Economy: NHTSA and EPA's Partnership for Setting Fuel Economy and Greenhouse Gas Emissions Standards Improved Analysis and Should Be Maintained

February 2010; 64 pp.; In English

Report No.(s): PB2010-107362; GAO-10-336; No Copyright; Avail.: CASI: A04, Hardcopy

In May 2009, the U.S. administration announced plans to increase the Department of Transportation's (DOT) National Highway Traffic Safety Administration's (NHTSA) corporate average fuel economy (CAFE) standards and establish the Environmental Protection Agency's (EPA) greenhouse gas (GHG) emissions standards for vehicles. NHTSA redesigned CAFE standards for light trucks for model years 2008 through 2011, and some experts raised questions about the rigor of the computer modeling NHTSA used to develop these standards. GAO was asked to review (1) the design of NHTSA and EPA's proposed standards; (2) how they are collaborating to set these standards; (3) improvements compared to a previous rulemaking, if any, NHTSA made to the modeling; and (4) the extent to which NHTSA analyzed the effects of past light truck standards and the accuracy of data used to set them. GAO reviewed relevant rulemaking and modeling documents, and interviewed agency officials and other experts.

NTIS

Air Pollution; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Motor Vehicles; Pollution Control

20100018764 Naval Facilities Engineering Service Center, Port Hueneme, CA USA

Diesel Engine Air Emissions Reduction Technologies

Helgeson, Norman; Trueblood, David; Holden, Bruce; Jack, Jason; Griffin, Gene; Apr 2010; 88 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-ESTCP-WP-0404

Report No.(s): AD-A518072; NFESC-TR-2328-ENV; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA518072

This report summarizes the results of a three-year project lead by the NAVFAC Engineering Service Center (NAVFAC ESC) to demonstrate the potential of two diesel engine exhaust gas treatment devices in reducing diesel engine particulate matter (PM) emissions. These devices, which are installed in the engine's exhaust system, are designed to trap engine PM emissions and periodically, chemically oxidize the soot through a process termed regeneration. The project was sponsored by the Environmental Security Technology Certification Program (ESTCP) with additional funding provided by Cummins, Inc. One of the tested devices, the ESW, Inc. Particulate Reactor, uses only the heat of the engine for regeneration, while the other, the Cummins, Inc. Robust Particulate Filter, also included the capability for direct fuel injection into the filter to provide additional heat. The demonstration results were that the ESW product reduced PM emissions by 50%, as expected, while the Cummins filter had significant performance issues which resulted in the suspension of its development as a commercial product.

DTIC

Air Pollution; Combustion Products; Control Equipment; Diesel Engines; Exhaust Emission; Exhaust Gases

20100019378 National Oceanic and Atmospheric Administration, Washington, DC, USA

U.S. Global Ocean Science Program: A Strategy for Understanding the Role of the Ocean in Global Change. A Report to the Ocean Principals

October 1987; 43 pp.; In English

Report No.(s): PB2010-104363; No Copyright; Avail.: CASI: A03, Hardcopy

This report represents the first stage of a coordinated, federal agency, strategic planning effort. The planning began in November 1985 in recognition of the urgency of describing and understanding the central role of the ocean in global change and the multiple effects of the ocean on our society. It presents the rationale for the U.S. Global Ocean Science Program, identifies the necessary components of science and technology, lays out the required actions for the short term, provides for continuing coordination, and estimates the level of effort, over a 7-year period centered upon FY 1989, required for the Program's success. The report, which will be updated annually, provides an interagency strategic planning mechanism that allows individual agencies to present a coordinated program structure for FY 1989.

NTIS

Oceans; Estimates; Coordination; Technologies

20100019384 Department of Energy, Aiken, SC, USA
First Interim Status Report: Model 9975 Life Extension Package Testing
Daugherty, W.; Stefek, T. M.; December 29, 2009; 31 pp.; In English
Contract(s)/Grant(s): DE-AC09-08SR22470
Report No.(s): DE2010-969996; SRNL-TR-2009-00439; No Copyright; Avail.: National Technical Information Service (NTIS)

Three 9975 packages have been instrumented and exposed to bounding storage conditions to help identify the extent to which laboratory test results for fiberboard, O-rings and other components apply within a full-scale package. To date, changes observed in the fiberboard overpack and Oring seals are generally consistent with the behavior of laboratory samples. The lead shield within each package has developed a corrosion layer of lead carbonate, consistent with other 9975 packages. However, the morphology of the corrosion layer is different within these packages, possibly as a result of the severity of the conditioning environments beyond normal service conditions. Conditioning of the second package, LE2, has been discontinued due to the degree of degradation of the fiberboard, and its components have received a final examination. Additional testing will be performed on samples removed from the fiberboard assembly to verify its final condition. The other two packages will continue in test.

NTIS
Radioactive Wastes; O Ring Seals; Boards (Paper); Degradation

20100019392 National Renewable Energy Lab., Golden, CO USA
Hybrid Taxis Give Fuel Economy a Lift. Clean Cities, Fleet Experiences
April 2009; 2 pp.; In English
Report No.(s): DE2010-952871; DOE-GO-102009-2776; No Copyright; Avail.: Department of Energy Information Bridge

Most people recognize the classic yellow-and-black taxicab, but some taxis are adopting a new color--green. Clean Cities helped Boston and Cambridge, Massachusetts, and San Antonio, Texas, create hybrid taxi programs that cut gasoline use and air pollution while pleasing drivers and passengers alike. Each year, taxis average 55,000 miles of driving. Most are Ford Crown Victorias, with a city fuel economy of about 16 miles per gallon (mpg). In contrast, the hybrid electric vehicles (HEVs) most commonly used as taxis do much better: The Toyota Prius gets 48 mpg in the city, the Ford Escape 34 mpg, and the Toyota Camry 33 mpg. Boston CleanAir CABS founder John Moore estimates that switching the entire Boston fleet of 1,900 taxis to HEVs would save about 5 million gallons of gasoline annually. In addition, hybrid taxis reduce smog-forming and greenhouse gas emissions, as well as create a green image for a city.

NTIS
Air Pollution; Electric Motor Vehicles; Pollution Control

20100019493 Environmental Protection Agency, Washington, DC USA
EPA National Forum on Vapor Intrusion, January 12-13, 2009, Loews Hotel, Philadelphia, PA: Proceedings
January 2009; 71 pp.; In English
Report No.(s): PB2010-107639; No Copyright; Avail.: National Technical Information Service (NTIS)

The environmental issue of vapor intrusion, which can result from soil and groundwater contamination in areas below a building, has become a priority topic for many areas of the country. These are typically areas where volatile organic compounds are present in the subsurface. Just when the contamination at many sites was thought to be under control, it's become obvious that this new exposure pathway is part of the environmental risk at many Superfund sites. In March, 2008 in San Diego, a workshop was held that brought together a number of practitioners and community members. People from both groups learned from each other. The regulators and industry representatives taught the community folks and the community folks (those impacted) shared their experiences about vapor intrusion in their homes. Soon after, there was a call for an east coast version of the workshop. It was called the 'EPA National Forum on Vapor Intrusion'. EPA Superfund and Technology Liaisons Bill Hagel (EPA Region 3) and Michael Gill (EPA Region 9) led this 2-day Forum, which was held in Philadelphia on January 1213, 2009. The Forum covered dual tracks highlighting community stakeholder and government issues. These following proceedings cover this Philadelphia gathering.

NTIS
Conferences; Contamination; Ground Water; Intrusion; Soil Pollution; Vapors

20100019500 Environmental Protection Agency, Research Triangle Park, NC, USA

Risk and Exposure Assessment to Support the Review of the Carbon Monoxide Primary National Ambient Air Quality Standards: Second External Review Draft

February 2010; 301 pp.; In English

Report No.(s): PB2010-107410; EPA/452/P-10/004; No Copyright; Avail.: National Technical Information Service (NTIS)

This draft document describes the quantitative human exposure assessment and risk characterization being conducted to inform the U.S. Environmental Protection Agency's (EPA's) current review of the National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO). This draft report, Risk and Exposure Assessment to Support the Review of the Carbon Monoxide Primary National Ambient Air Quality Standards: Second External Review Draft, is being provided to the Clean Air Scientific Advisory Committee (CASAC) CO Panel and the public for review in advance of a public meeting of the CASAC CO panel planned for March 22-23, 2010. Following that meeting, we will take CASAC and public comments into account in preparing the final document. We plan to complete the final Risk and Exposure Assessment report in May 2010. Given the significant time constraints of this review, results of the assessment are provided in this document without substantial interpretation. Rather, interpretative discussion of these results is provided in the draft Policy Assessment.

NTIS

Air Pollution; Air Quality; Ambience; Carbon Monoxide; Exposure; Health; Risk Assessment

20100019502 Environmental Protection Agency, Research Triangle Park, NC, USA

Policy Assessment for the Review of the Particulate Matter National Ambient Air Quality Standards. First External Review Draft

March 2010; 285 pp.; In English

Report No.(s): PB2010-107407; EPA/452/P-10/003; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Environmental Protection Agency (EPA) is presently conducting a review of the national ambient air quality standards (NAAQS) for particulate matter (PM). The overall plan and schedule for this review were presented in the Integrated Review Plan for the National Ambient Air Quality Standards for Particulate Matter (IRP; US EPA, 2008a). The IRP identified key policy-relevant issues to be addressed in this review as a series of questions that frame our consideration of whether the current NAAQS for PM should be retained or revised. This Policy Assessment (PA), prepared by staff in the EPA's Office of Air Quality Planning and Standards (OAQPS), is intended to help 'bridge the gap' between the relevant scientific information and assessments and the judgments required of the EPA Administrator in determining whether, and if so, how, it is appropriate to revise the NAAQS for PM. This first draft PA presents factors relevant to EPA's review of the primary (health-based) and secondary (welfare-based) PM NAAQS. It focuses on both evidence- and risk-based information in evaluating the adequacy of the current PM NAAQS and in identifying potential alternative standards for consideration.

NTIS

Air Quality; Ambience; Cities; Particulates; Policies

20100019503 Environmental Protection Agency, Research Triangle Park, NC, USA

Particulate Matter Urban-Focused Visibility Assessment. Second External Review Draft

January 2010; 246 pp.; In English

Report No.(s): PB2010-107406; EPA/452/P-10/002; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Environmental Protection Agency (EPA) is presently conducting a review of the national ambient air quality standards (NAAQS) for particulate matter (PM). Sections 108 and 109 of the Clean Air Act (Act) govern the establishment and periodic review of the NAAQS. The NAAQS are to be based on air quality criteria, which are to accurately reflect the latest scientific knowledge useful in indicating the kind and extent of identifiable effects on public health or welfare that may be expected from the presence of the pollutant in ambient air. The EPA Administrator is to promulgate and periodically review, at no later than five-year intervals, 'primary' (health-based) and 'secondary' (welfare-based) NAAQS for such pollutants. Based on periodic reviews of the air quality criteria and standards, the Administrator is to make revisions in the air quality criteria and standards, and to promulgate any new standards, as may be appropriate. The Act also requires that an independent scientific review committee advise the Administrator as part of this NAAQS review process, a function performed by the Clean Air Scientific Advisory Committee (CASAC).

NTIS

Air Quality; Cities; Particulates; Visibility; Pollution Monitoring

20100019524 Environmental Protection Agency, Research Triangle Park, NC USA
Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2003, Annual Report
Hall, E. S.; Dimmick, F.; Tikvart, J.; Feb. 2010; 168 pp.; In English
Contract(s)/Grant(s): EPA-RW75922615-01-0; CDC-07FED63951
Report No.(s): PB2010-107593; EPA/600/R-10/018; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O(sub 3) and PM(sub 2.5) concentrations throughout the continental USA during the 2003 calendar year. HBM estimates provide the spatial and temporal variance of O(sub 3) and PM(sub 2.5), allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical fusion of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.
NTIS
Air Quality; Bayes Theorem; Estimates; Mathematical Models

20100019525 Environmental Protection Agency, Research Triangle Park, NC USA
Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2002, Annual Report
Hall, E. S.; Dimmick, F.; Tikvart, J.; Feb. 2010; 168 pp.; In English
Contract(s)/Grant(s): EPA-RW75922615-01-0; CDC-07FED63951
Report No.(s): PB2010-107592; EPA/600/R-10/017; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O(sub 3) and PM(sub 2.5) concentrations throughout the continental USA during the 2002 calendar year. HBM estimates provide the spatial and temporal variance of O(sub 3) and PM(sub 2.5), allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical fusion of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.
NTIS
Air Quality; Bayes Theorem; Estimates; Mathematical Models

20100019572 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Options to Accelerate Ozone Recovery: Ozone and Climate Benefits
Fleming, E. L.; Daniel, J. S.; Portmann, R. W.; Velders, G. J. M.; Jackman, C. H.; Ravishankara, A. R.; March 29, 2010; 24 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019572

The humankind or anthropogenic influence on ozone primarily originated from the chlorofluorocarbons and halons (chlorine and bromine). Representatives from governments have met periodically over the years to establish international regulations starting with the Montreal Protocol in 1987, which greatly limited the release of these ozone-depleting substances (DDSs). Two global models have been used to investigate the impact of hypothetical reductions in future emissions of ODSs on total column ozone. The investigations primarily focused on chlorine- and bromine-containing gases, but some computations also included nitrous oxide (N2O). The Montreal Protocol with ODS controls have been so successful that further regulations of chlorine- and bromine-containing gases could have only a fraction of the impact that regulations already in force have had. if all anthropogenic ODS emissions were halted beginning in 2011, ozone is calculated to be higher by about 1-2% during the period 2030-2100 compared to a case of no additional ODS restrictions. Chlorine- and bromine-containing gases and nitrous oxide are also greenhouse gases and lead to warming of the troposphere. Elimination of N 20 emissions would result in a reduction of radiative forcing of 0.23 W/sq m in 2100 than presently computed and destruction of the CFC bank would produce a reduction in radiative forcing of 0.005 W/sq m in 2100. This paper provides a quantitative way to consider future regulations of the CFC bank and N 20 emissions
Author
Climate; Ozone; Chlorofluorocarbons; Chlorine; Bromine; Nitrous Oxides; Radiative Forcing; Halon; Greenhouse Effect; Environment Effects

20100019676 Library of Congress, Washington, DC USA

North Korea's 2009 Nuclear Test: Containment, Monitoring, Implications

Medalia, Jonathan; Apr 2, 2010; 38 pp.; In English

Report No.(s): AD-A518949; CRS-R41160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518949

On May 25, 2009, North Korea announced that it had conducted its second underground nuclear test. Unlike its first test, in 2006, there is no public record that the second one released radioactive materials indicative of a nuclear explosion. How could North Korea have contained these materials from the May 2009 event and what are the implications? The Comprehensive Nuclear-Test-Ban Treaty establishes a verification mechanism, including an International Monitoring System (IMS) to detect nuclear tests. Three IMS technologies detect waves that pass through the oceans (hydroacoustic), Earth (seismic), or atmosphere (infrasound); a fourth detects radioactive material from a nuclear test. Scientists concur that only the latter proves that an explosion was nuclear. Some believe that deep burial and other means can contain radioactive effluents. Another view is that containment is an art as much as a science. The USA learned to improve containment over several decades. Yet by one estimate, North Korea contained over 99.9% of the radioactive effluents from its 2009 test. It might have done so by application of lessons learned from its 2006 test or the U.S. nuclear test experience, use of a higher-yield device, release of material below the detection threshold, good luck, or some combination. Alternatively, the 2009 event may have been a nonnuclear explosion designed to simulate a nuclear test. Containment could be of value to North Korea.

DTIC

Containment; North Korea; Nuclear Explosions

20100019955 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Method of Measuring the Economic Impact of a Radiological Dispersal Event within an Urban Environment

Munfakh, Antoine N; Mar 2010; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519531; AFIT/GFA/ENV/10-M03; XC-AFRL/HPW-711; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Radiological Dispersal Event (RDE) is the result of a Radiological Dispersal Device (RDD), or a dirty bomb. An RDD is a low-yield conventional bomb surrounded by radiological material, such as Cesium-137 or Cobalt-60. Upon detonation, the blast of the conventional explosive is designed to spread the radiological material over a wide area. The radiological material will then be inhaled or ingested by people, or otherwise absorbed into the environment. An RDD is an affordable, feasible, and economically devastating option for terrorist groups. Radiological material can be stolen or acquired cheaply from the millions of radioactive sources used worldwide in industry, medicine, and academia. The purpose of this research is to develop a methodology to assess the economic impacts resulting from an RDE in an urban center. Specifically, the author used an Input-Output model to evaluate the economic impacts of an RDE in three districts of an urban center modeled after Dayton, Ohio: the industrial district, the retail district, and the central business district. The study showed that the direct, indirect, and induced costs of the RDE remained consistent independent of the district at approximately 60%, 15%, and 25%, respectively. Previous attempts to quantify the impact of an RDE only measured the direct costs, thus failing to capture approximately 40% of the total costs of such an event. The 1-year costs of an RDE in a central business district would be approximately $1.4, and it would affect approximately 860 firms in 270 distinct industries. Approximately 18,000 workers would be unemployed immediately following the attack, and an additional 113,000 people would be affected by the shift in the local economy as a result of indirect and induced costs. The methodology can be generalized to other regions or cities.

DTIC

Cities; Costs; Dispersing; Economic Analysis; Economic Impact; Radioactive Materials; Radiology; Warfare

20100020129 Environmental Protection Agency, Washington, DC, USA; National Highway Traffic Safety Administration, Washington, DC, USA

Light-Duty Vehicle Greenhouse Gas Emissions Inventory for Air Quality Modeling Technical Support Document

Apr. 2010; 48 pp.; In English

Report No.(s): PB2010-108662; EPA-420-R-10-011; No Copyright; Avail.: CASI: A03, Hardcopy

This document provides the details of emissions data processing done in support of the Environmental Protection Agency (EPA) and National Highway Traffic Safety Administration (NHTSA) joint rulemaking effort to establish Light Duty Vehicle Greenhouse Gas (LDGHG) Emissions Standards and Corporate Average Fuel Economy (CAFE) Standards. The emissions and

modeling effort is hereafter referred to as LDGHG and consists of three emissions cases. Table 1 provides of list of the emissions cases created for this modeling effort.
NTIS
Air Quality; Combustion Products; Environment Models; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Inventories; Motor Vehicles

20100020130 FEV Engine Technology, Inc., Auburn Hills, MI, USA
Light-Duty Technology Cost Analysis. Report on Additional Case Studies
Apr. 2010; 184 pp.; In English
Contract(s)/Grant(s): EP-C-07-069
Report No.(s): PB2010-108661; EPA-420-R-10-010; No Copyright; Avail.: National Technical Information Service (NTIS)

The USA Environmental Protection Agency (EPA) contracted with FEV, Inc. to determine the incremental direct manufacturing costs for a set of advanced, light-duty vehicle technologies. The technologies selected are on the leading edge for reducing emissions of greenhouse gases in the future, primarily in the form of tailpipe carbon dioxide (CO2). This report, the second in a series of reports, addresses the direct incremental manufacturing cost of four (4) new powertrain configurations, relative to four (4) existing baseline configurations, with comparable driver performance metrics.
NTIS
Cost Analysis; Motor Vehicles; Technology Assessment

20100020131 Environmental Protection Agency, Washington, DC, USA; National Highway Traffic Safety Administration, Washington, DC, USA
Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards. Regulatory Impact Analysis
Apr. 2010; 474 pp.; In English
Report No.(s): PB2010-108660; EPA-420-R-10-009; No Copyright; Avail.: National Technical Information Service (NTIS)

The Environmental Protection Agency (EPA) and the National Highway Traffic Safety Administration (NHTSA) are issuing a joint final rulemaking to establish new standards for light-duty highway vehicles that will reduce greenhouse gas emissions (GHG) and improve fuel economy. The joint rulemaking is consistent with the National Fuel Efficiency Policy announced by President Obama on May 19, 2009, responding to the country's critical need to address global climate change and to reduce oil consumption. EPA is finalizing greenhouse gas emissions standards under the Clean Air Act, and NHTSA is finalizing Corporate Average Fuel Economy standards under the Energy Policy and Conservation Act (EPCA), as amended. These standards apply to passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years (MY) 2012 through 2016. The standards will require these vehicles to meet an estimated combined average emissions level of 250 grams of CO2 per mile in MY 2016 under EPA's GHG program, and 34.1 mpg in MY 2016 under NHTSA's CAFE program and represent a harmonized and consistent national program. These standards are designed such that compliance can be achieved with a single national vehicle fleet whose emissions and fuel economy performance improves year over year.
NTIS
Air Pollution; Combustion Products; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Motor Vehicles; Organizations; Pollution Control; Standards

20100020132 Environmental Protection Agency, Washington, DC, USA
Light-Duty Technology Cost Analysis Pilot Study. Peer Review Report-Response to Comments Document
Dec. 2009; 26 pp.; In English
Report No.(s): PB2010-108658; EPA-420-R-09-021; No Copyright; Avail.: CASI: A03, Hardcopy

As the Environmental Protection Agency's (EPA) Office of Transportation and Air Quality develops its programs to control greenhouse gas (GHG) emissions from light-duty highway vehicles, there is a need to evaluate the costs of technologies likely to be used to meet these standards. EPA contracted with FEV, Inc., to perform this cost analysis through tearing down vehicles, engines, and components, both with and without these technologies, and evaluating, part by part, the observed differences in size, weight, materials, machining steps, and other cost-affecting parameters. Though complex and time-consuming, EPA believes this approach has great potential for determining accurate technology costs, a goal that is of paramount importance in the setting of appropriate GHG standards. EPA tasked ICF International (ICF), an independent

third-party contractor, to conduct a peer review of the cost analysis now in progress to assure that this work incorporates the highest quality science.
NTIS
Cost Analysis; Motor Vehicles; Technology Assessment

20100020133 FEV Engine Technology, Inc., Auburn Hills, MI, USA
Light-Duty Technology Cost Analysis Pilot Study
Dec. 2009; 317 pp.; In English
Report No.(s): PB2010-108657; EPA-420-R-09-020; No Copyright; Avail.: National Technical Information Service (NTIS)

The USA Environmental Protection Agency (EPA) contracted with FEV, Inc. to determine incremental direct manufacturing costs for a set of advanced light-duty vehicle technologies. The technologies selected are on the leading edge for reducing emissions of greenhouse gases in the future, primarily in the form of tailpipe carbon dioxide (CO2). In contrast to comparable cost analyses done in the past, which rely heavily on supplier price quotes for key components, this study is based to a large degree on teardowns of vehicles or vehicle systems that employ the new technologies, and of similar vehicles or systems without the new technologies. Analysts with expertise in automotive design, materials, and manufacturing then compare the teardown components and evaluate the differences. Using databases for materials, labor, manufacturing overhead, and mark-up costs, the overall cost to manufacture individual parts are calculated and summed into final results. A model consisting of an extensive set of linked spreadsheets and associated macros has been developed to perform the calculations, to track the input data, identify sources of information, describe assumptions used in the case study, and provide analysis tools.
NTIS
Cost Analysis; Motor Vehicles; Technology Assessment

20100020134 Southwest Research Inst., San Antonio, TX USA
Peer Review of the Optimization Model for Reducing Emissions of Greenhouse Gases from Automobiles (OMEGA) and EPA's Response to Comments
Sep. 2009; 156 pp.; In English
Report No.(s): PB2010-108656; EPA-420-R-09-016; No Copyright; Avail.: CASI: A08, Hardcopy

On-road vehicles are the predominant source of greenhouse gas (GHG) emissions in the transportation sector (principally, CO2 and hydrocarbon emissions from vehicle air conditioners). Of all on-road vehicles, light-duty passenger cars and trucks produce the majority of these GHG emissions. As EPA's Office of Transportation and Air Quality explores the regulation of CO2 and other GHG emission control measures in on-road and non-road vehicles and equipment, there is a need to evaluate the costs and benefits of any such regulations. As such, EPA has developed its Vehicle Greenhouse Gas Emissions Cost and Compliance Model, or VGHG model, to facilitate its analysis of the costs and benefits of the control of GHG emissions from cars and trucks. Broadly speaking, the primary cost of GHG emission control is the cost of adding technology to the vehicles, while the primary benefit is the value of reduced fuel consumption in those same vehicles.
NTIS
Automobiles; Greenhouse Effect

20100020135 Environmental Protection Agency, Washington, DC USA
EPA Staff Technical Report: Cost and Effectiveness Estimates of Technologies Used to Reduce Light-duty Vehicle Carbon Dioxide Emissions
Mar. 2008; 82 pp.; In English
Report No.(s): PB2010-108655; EPA-420-R-08-008; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents EPA technical staff current assessment of the costs and effectiveness from a broad range of technologies which can be applied to cars and light-duty trucks. The report is divided into four major sections. In Section 1, we discuss the methodology used to develop cost and effectiveness estimates, including what data sources we relied upon. In Section 2, we present our estimates of the carbon dioxide (CO2) reduction potential of nearly 40 individual technologies covering five broad categories: engines, transmissions, hybrids, accessories, and others (e.g., aerodynamic improvements). These estimates are for individual technologies compared to a baseline vehicle, and the estimated effectiveness cannot simply be added up when considering a combination of technologies. This issue is addressed in Section 3 of the report, which discusses the synergistic effects of combining multiple technologies and provides an estimate of the magnitude of this impact on CO2 reduction effectiveness. Finally, Section 4 provides an estimate of the direct costs associated with each of the

technologies, as well as a discussion of estimating indirect costs and the potential for future cost reductions.
NTIS
Carbon Dioxide; Combustion Products; Cost Effectiveness; Estimates; Exhaust Emission; Exhaust Gases; Motor Vehicles

20100020143 Environmental Protection Agency, Research Triangle Park, NC USA
Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2006, Annual Report
Hall, E. S.; Dimmick, F.; Tikvart, J.; February 2010; 168 pp.; In English
Contract(s)/Grant(s): EPA-RW75922615-01-0; CDC-07FED63951
Report No.(s): PB2010-107596; EPA/600/R-10/021; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O(sub 3) and PM(sub 2.5) concentrations throughout the continental USA during the 2006 calendar year. HBM estimates provide the spatial and temporal variance of O(sub 3) and PM(sub 2.5), allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical fusion of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.
NTIS
Air Quality; Bayes Theorem; Estimates; Mathematical Models

20100020145 Environmental Protection Agency, Research Triangle Park, NC USA
Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2005, Annual Report
Hall, E. S.; Dimmick, F.; Tikvart, J.; February 2010; 168 pp.; In English
Contract(s)/Grant(s): EPA-RW75922615-01-0; CDC-07FED63951
Report No.(s): PB2010-107595; EPA/600/R-10/020; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O(sub 3) and PM(sub 2.5) concentrations throughout the continental USA during the 2005 calendar year. HBM estimates provide the spatial and temporal variance of O(sub 3) and PM(sub 2.5), allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical fusion of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.
NTIS
Air Quality; Bayes Theorem; Estimates; Mathematical Models

20100020146 Ricardo North America, Inc., Burr Ridge, IL, USA
Study of Potential Effectiveness of Carbon Dioxide Reducing Vehicle Technologies. Revised Final Report
June 2008; 126 pp.; In English
Contract(s)/Grant(s): EP-C-06-003
Report No.(s): PB2010-108654; EPA-420-R-08-004A; No Copyright; Avail.: National Technical Information Service (NTIS)

Ricardo has been subcontracted by Perrin Quarles Associates, Inc. (PQA) under contract to the EPA to carry out an objective and scientific analysis of the influence of certain technology packages on automotive CO2 emissions and vehicle performance. The scope of the study was to determine the quantitative impact of technology combinations, or packages, when applied to baseline vehicles. The EPA selected the vehicle classes and the technology packages which were applied, as well as a baseline comparator vehicle for each class. Vehicle performance metrics were considered simultaneously with CO2 emissions in order to indicate the potential impact on consumer acceptability. Vehicle performance metrics were considered an important part of the study as these can significantly influence the desirability of a vehicle to car buyers.
NTIS
Air Pollution; Carbon Dioxide; Motor Vehicles; Pollution Control; Technology Assessment

20100020148 Environmental Protection Agency, Washington, DC, USA
Wedge Analysis of the U.S. Transportation Sector
Mui, S.; Alson, J.; Ellies, B.; Ganss, D.; April 2007; 24 pp.; In English
Report No.(s): PB2010-108653; EPA-420-R-07-007; No Copyright; Avail.: National Technical Information Service (NTIS)

The concept of stabilization wedges is introduced and applied to the U.S. transportation sector in order to assess the potential of approaches that could reduce both greenhouse gas emissions (GHGs) and petroleum consumption. Three general approaches are assessed using a wedge analysis, including (1) improvements in vehicle technology, (2) switching to lower-GHG fuels, and (3) utilization of travel demand management (TDM). A broad range of assumptions are considered for each of these approaches, reflecting the wide range of estimates regarding alternative transportation fuels, improvements in vehicle technology, and potential reductions in TDM. A wedge analysis is used to help frame the issues involved and to compare the numerous transportation approaches using a common metric namely a wedge count. It is shown that approximately nine U.S. transportation sector wedges, each representing 5,000 MMT CO2e of cumulative reductions between now and 2050, would be enough to flatten emissions in the sector.
NTIS
Fuel Consumption; Greenhouse Effect; Transportation; Wedges

20100020153 Environmental Protection Agency, Washington, DC, USA; ICF Consulting, Fairfax, VA, USA
Greenhouse Gas Emissions from the U.S. Transportation Sector, 1990-2003
March 2006; 68 pp.; In English
Report No.(s): PB2010-108651; EPA-420-R-06-003; No Copyright; Avail.: National Technical Information Service (NTIS)

This report was developed by the U.S. Environmental Protection Agency's (EPA) Office of Transportation and Air Quality (OTAQ) to help transportation agencies, the transportation industry, researchers, and the public better understand the connection between transportation and GHG emissions in the USA. The GHG emissions estimates presented in this report are taken from the official GHG Inventory produced by EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 19902003 (U.S. GHG Inventory). As a complement to the U.S. GHG Inventory, this report includes additional detail on GHG emissions from transportation and non-transportation mobile sources. It also analyzes factors affecting emissions, uncertainty in the data, and emerging issues.
NTIS
Air Pollution; Exhaust Emission; Exhaust Gases; Greenhouse Effect; Pollution Control; Transportation

20100020155 Environmental Protection Agency, Washington, DC, USA
Temperature Corrections for Nonroad Exhaust Emissions
December 2005; 4 pp.; In English
Report No.(s): PB2010-108649; EPA-420-R-05-014; No Copyright; Avail.: CASI: A01, Hardcopy

This report documents how the final NONROAD2005 emission inventory model accounts for the effects of temperature on four-stroke exhaust emissions. RVP and temperature also affect both vapor displacement, which is covered in NR-013b (Refueling Emissions for Nonroad Engine Modeling) as well as diurnal emissions, which are covered in NR-012c (Nonroad Evaporative Emission Rates).
NTIS
Correction; Exhaust Emission; Inventories

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20100018737 Naval Research Lab., Washington, DC USA
On Tropical Cyclone Formation
Peng, M S; Fu, B; Li, T; Jan 2008; 3 pp.; In English
Report No.(s): AD-A518007; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518007

The formation (genesis) of tropical cyclones (TCs) is a complicated process that involves interactions among multi-scale circulations. While tropical disturbances exist all the time, only a few of them may develop into TCs. In this study, the daily

global analysis from the Navy Operational Global Atmospheric Prediction System (NOGAPS) is examined to understand why some disturbances develop into TCs while others do not. Significantly different characteristics of atmospheric variables associated with developing and nondeveloping disturbances are found. The most important parameter controlling TC formation is vertical wind shear in the North Atlantic (NA) and low-level, large-scale convergence in the western North Pacific (WNP). The result suggests that different cyclogenesis mechanisms may operate for TC formation in the two oceanic basins.
DTIC
Atlantic Ocean; Atmospheric Models; Cyclones; Forecasting; Marine Meteorology; Navy; Pacific Ocean; Tropical Storms

20100018738 Naval Research Lab., Washington, DC USA
SHIMMER: Innovative Technology Enabling Unprecedented Science
Englert, C R; Stevens, M H; Siskind, D E; Eckermann, S D; Harlander, J M; Nielsen, K; Roesler, F L; Jan 2008; 4 pp.; In English
Report No.(s): AD-A518010; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518010

On March 9, 2007, the first ultraviolet spectrometer using the innovative optical technique known as spatial heterodyne spectroscopy was launched into low Earth orbit from Cape Canaveral, FL. The Spatial Heterodyne Imager for Mesospheric Radicals (SHIMMER) is a deskjet printer-sized rugged spectrometer designed to measure solar resonance fluorescence of hydroxyl (OH) in the Earth's middle atmosphere between 30 and 100 km altitude. It is optimized for high spectral resolution, low mass, low power, low volume, and high sensitivity with no moving parts. SHIMMER is performing as expected and has already returned several hundred thousand atmospheric OH measurements. SHIMMER also detects mesospheric clouds (MCs) at their equatorward edge region, around 55 degrees latitude, where they are believed to be most sensitive to mesospheric change. SHIMMER's unprecedented local time coverage allows the investigation of how atmospheric dynamics influence MCs and their environment and thus potentially bias the interpretation of multi-decadal cloud frequency and brightness trends. To date, SHIMMER data have already led to three significant science results, discussed briefly here.
DTIC
Earth Atmosphere; Fluorescence; Heterodyning; High Resolution; Hydroxyl Radicals; Image Processing; Mesosphere; Radicals; Spectroscopy

20100018786 Army War Coll., Carlisle Barracks, PA USA
Engagement in the Arctic
Anderson, James E; Feb 17, 2010; 29 pp.; In English
Report No.(s): AD-A518120; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518120

Global warming continues to accelerate the melting Arctic Ocean ice pack. The Northwest Passage was open during summer months for the first time in 2007. Estimates indicate that the summertime Arctic Ocean may be ice-free within the next few decades. Along with untapped mineral & marine life resources, a year-round ice-free Northwest Passage could decrease the journey from Europe to Asia by 2,500 miles. Recent estimates indicate over one fifth of the world's undiscovered oil and gas reside in the Arctic Ocean. Five of the eight countries in the Arctic Council have land that borders the Arctic Ocean. International law does not govern the region under the icepack, but the 1982 United Nations Convention on the Law of the Sea (UNCLOS) establishes that countries have exclusive economic rights to a 200 nautical mile (nmi) zone from their coastlines. In 2007 Russia planted a flag 14,000 feet below the North Pole claiming ownership of an area the size of Western Europe. The goal of this paper is to provide impetus for policy development that will allow the USA to be in a position to meet our national interests when the as the Arctic Ocean presents more challenges and opportunities.
DTIC
Arctic Regions; Greenhouse Effect

20100018808 Battelle Pacific Northwest Labs., Richland, WA USA
A Mathematical Statistics Formulation of the Teleseismic Explosion Identification Problem with Multiple Discriminants
Anderson, Dale N; Fagan, Deborah K; Tinker, Mark A; Kraft, Gordon D; Hutchenson, Kevin D; Sep 2007; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-AC05-RLO1830/PL07-ECM-NEM02; FA8620-05-C-4301
Report No.(s): AD-A518199; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518199

Seismic monitoring for underground nuclear explosions answers three questions for all global seismic activity: Where is

the seismic event located? What is the event source type (event identification)? If the event is an explosion, what is the yield? The answers to these questions involve processing seismometer waveforms with propagation paths predominately in the mantle. Four discriminants commonly used to identify teleseismic events are depth from travel time, presence of long-period surface energy (mb versus Ms), depth from reflective phases, and polarity of first motion. The seismic theory for these discriminants is well established in the literature (see for example Pomeroy et al. [1982] and Blandford [1982]). However the physical basis of each has not been formally integrated into probability models to account for statistical error and provide discriminant calculations generally appropriate for multi-dimensional event identification. This paper develops a mathematical statistics formulation of these discriminants and offers a novel approach to multi-dimensional discrimination that is readily extensible to other discriminants. For each discriminant a probability model is formulated under a general null hypothesis of H0: Explosion Characteristics. The veracity of the hypothesized model is measured with a p-value calculation (see Stuart et al. [1994] and Freedman et al. [1991]) that is filtered to be approximately normally distributed and is in the range [0, 1]. A value near zero rejects H0, and a moderate to large value indicates consistency with H0. The hypothesis test formulation ensures that seismic phenomenology is tied to the interpretation of the p-value. These p-values are then embedded into a multi-discriminant algorithm that is developed from regularized discrimination methods proposed by Smidt and McDonald (1976), DiPillo (1976) and Friedman (1989). Performance of the methods is demonstrated with 102 teleseismic events with magnitudes (mb) ranging from
DTIC
Explosions; Nuclear Explosions; Seismic Waves; Statistical Analysis

20100018822 Naval Research Lab., Washington, DC USA
Remotely Measuring Turbulent Coastal Atmospheres
Hooper, W P; Frick, G M; Michael, B P; Lind, R J; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518227; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518227

In April and May 2006, personnel from the Remote Sensing Division conducted joint measurements with Naval Postgraduate School (NPS) personnel in testing the capabilities of a recently developed eye-safe lidar that tracks the movement of large aerosol structures (Fig. 5). The test was conducted at Point Sur, CA, a rugged coastal region 30 km south of Monterey, CA, noted for high winds. In coastal areas where winds and large shoaling waves make in situ measurements difficult, scanning lidars represent a powerful tool for remotely measuring the winds and visualizing the airflow.
DTIC
Coasts; Detection; Earth Atmosphere; Optical Radar; Remote Sensing; Turbulence; Turbulent Flow

20100018930 Naval Research Lab., Washington, DC USA
Understanding the Effect of Atmospheric Turbulence on Optical and Infrared Propagation using Hilbert Phase Analysis
Font, C; Gilbreath, G C; Chang, M P; Oh, E S; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The refractive index structure parameter C(2/n) is a figure of merit used to describe the magnitude of the effect of turbulence in the atmosphere. Understanding the influence of different local climate parameters upon C(2/n) is an important step toward developing a prediction model for in-field laser interrogators. The layered structure of the atmosphere and its random behavior present unique challenges to theoretical and experimental studies in propagation research. This article presents a novel technique termed Hilbert Phase Analysis (HPA) to provide insights into the physical interactions. We explore the technique's use in analyzing the dependence of C(2/n) on local climate variables using data recently obtained from campaigns conducted in Puerto Rico.
DTIC
Atmospheric Circulation; Atmospheric Turbulence; Earth Atmosphere; Hilbert Space; Infrared Detectors; Infrared Radiation; Optical Measuring Instruments; Refractivity; Turbulence

20100018941 Naval Research Lab., Monterey, CA USA
The Terrain-Induced Rotor Experiment (T-REX)
Doyle, J D; Grubisic, V; Jan 2007; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518505; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Terrain-induced Rotor Experiment (T-REX) is a coordinated international effort focused on exploring the structure

and evolution of atmospheric rotors and associated phenomena in complex terrain. Atmospheric rotors are intense low-level horizontal vortices that form along an axis parallel to and downstream of a mountain ridge crest in association with large-amplitude mountain waves. High levels of turbulence characterize rotors, which are known to pose a great hazard to aviation. Recent numerical, theoretical, and observational studies of rotors show that rotors are strongly coupled to both the structure and evolution of overlying mountain waves and to the underlying boundary layer. Consequently, the overarching objective of T-REX is to study synergistic interaction between rotors, mountain waves, and boundary layer dynamics. The T-REX field campaign was centered on the Owens Valley in the lee of the southern Sierra Nevada in eastern California. This portion of the Sierra Nevada is the tallest, quasi two-dimensional topographic barrier in the contiguous USA; it includes the highest peak in the lower 48 states (Mt. Whitney 4,418 m) and the steepest lee slopes.
DTIC
Atmospheric Circulation; Atmospheric Models; Mathematical Models; Mountains; Rotors; Terrain

20100018958 National Oceanic and Atmospheric Administration, Bay Saint Louis, MS USA
Operational Performance of the Second Generation Deep-Ocean Assessment and Reporting of Tsunamis (DART (trademark) II)
Bouchard, Richard; McArthur, Shannon; Hansen, William; Kern, Kevin J; Locke, Lea; Jan 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In March 2005, the National Oceanic and Atmospheric Administration (NOAA) completed the transition from research to operations of the second generation of the Deep-ocean Assessment and Reporting of Tsunamis (DART(TM) II). DART(TM) II systems are a part of NOAA's Tsunami Program, which is part of a cooperative effort to save lives and protect property through hazard assessment, warning guidance, mitigation, research capabilities, and international coordination. NOAA's National Weather Service (NWS) is responsible for the overall execution of the Tsunami Program. Among its responsibilities under the Tsunami Program, NWS acquires, operates, and maintains observation systems required in support of tsunami warning, such as DART(TM). NWS also supports observations and data management through the National Data Buoy Center (NDBC). The DART(TM) II systems join NWS base stations, the Tropical Atmosphere Ocean Array, and the Coastal Marine Automated Network stations in the NOAA/NWS/NDBC Ocean Observing System of Systems (NOOSS). In the two years since being declared operational: (1) DART(TM) II systems have replaced all but three DART(TM) I systems, (2) DART(TM) network has expanded to 28 stations stretched across the Pacific and now into the North Atlantic, Caribbean Sea, and the Gulf of Mexico. (3) Three DART(TM) II systems have been provided to other countries to aid in their tsunami warning capability, (4) DART(TM) II systems provided estimated water-level information for the 2006 events in Tonga, Hawai'i, Kuril Islands, and Taiwan. In 2007, DART(TM) II systems provided observations for the Solomon Islands event and another Kuril Islands event. (5) DART(TM) II data availability for the standard mode observations have been more than 85% exceeding the target data availability goal of 80%.
DTIC
Data Management; Ocean Bottom; Tsunami Waves

20100018966 Naval Postgraduate School, Monterey, CA USA
Interagency Modeling Atmospheric Assessment Center Local Jurisdiction: IMAAC Operations Framework
Dadosky, Edward J; Mar 2010; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Interagency Modeling Atmospheric Assessment Center (IMAAC) is a Department of Homeland Security (DHS) interagency working group responsible to create atmospheric air plume dispersion model predictions for designated emergencies. When activated IMAAC is comprised of representatives from eight federal agencies with the National Atmospheric Release Advisory Center (NARAC) serving as the interim host. The Center concept was designed to eliminate contradictory plume predictions during weapons of mass of destruction (WMD) and hazardous materials incidents. IMAAC plume predictions represent the federal position during such emergencies. IMAAC resources are also available to assist local jurisdictions during incidents requiring federal coordination as cited by the DHS National Response Framework. An operations framework model has been devised in this thesis to address ongoing plume modeling issues between IMAAC and first responders in need of fast and accurate plume predictions during accidental or intentional spills, releases, or discharges of WMD or hazardous materials into the environment. The proposed operations framework model is designed to address related obstacles facing first responders including IMAAC Web-based and stand-alone models accessibility, incident reach back support, coordinated procedures, training, exercises, and funding.
DTIC
Atmospheric Models; Destruction; Internets; Plumes; Project Management; Security

20100019341 Alliant Techsystems, Inc., Minneapolis, MN USA

Applications of a Constrained Inversion and an Extended Kriging Method to Improve Source, Path, and Site Corrections for Regional Seismic Phases

Fisk, Mark D; Taylor, Steven R; Proceedings of the Monitoring Research Review (30th): Ground-Based Nuclear Explosion Monitoring Technologies; Sep. 2008; 11 pp.; In English; Monitoring Research Review (30th): Ground-Based Nuclear Explosion Monitoring Technologies, 23-25 Sep. 2008, Portsmouth, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-AC52-06NA27321

Report No.(s): AD-A518299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives are to develop and apply two methods to improve source and path corrections for regional seismic phases. In first, we estimate and constrain source parameters using Brune model fits to relative spectra of regional seismic phases for event pairs with similar locations and focal mechanisms, but different seismic moments. We then use source-corrected spectra to estimate geometrical spreading, Q, and site terms for Pn, Pg, Sn, and Lg. We performed preliminary study using waveform cross-correlations to find suitable pairs. Using Preliminary Determination of Epicenters catalog, we formed a list of candidate pairs and computed waveform cross-correlations to find pairs of similar events. We computed and fit network-median relative spectra for 3,600 pairs. We automated processing steps, reviewing and refining results. We merged results with previous to obtain more extensive estimates of source corner frequencies versus moment and stress-drop parameters. We generated kriged grids of stress drop and associated uncertainties. We fit combined distance and site terms to the source-corrected spectra, showing robust estimates of these effects are possible by first constraining source terms. Second method, an extension to Bayesian kriging, provides robust path corrections and uncertainties for regional phase amplitudes, that properly treats localized calibration events that may have anomalous, correlated amplitudes. Clusters of anomalous reference events can significantly bias kriged amplitude corrections and uncertainties. Fisk and McCartor developed a fundamental improvement to kriging methodology, incorporating an additional correlation length to treat similar focal mechanisms, and tested the method on large samples of underground nuclear explosions and earthquakes. Application to worldwide datasets indicates power of hypothesis test to reject earthquakes as explosions is marginally reduced, without miscategorizing known explosions and providing robust treatment of clu

DTIC

Correction; Earthquakes; Inversions; Kriging; Seismology; Underground Explosions

20100019412 Lawrence Livermore National Lab., Livermore, CA USA

Attenuation Tomography of Northern California and the Yellow Sea/Korean Peninsula from Coda-Source Normalized and Direct LG Amplitudes

Ford, Sean R.; Dreger, Douglas S.; Phillips, William S.; Walter, William R.; Mayeda, Kevin; Malagnini, Luca; Proceedings of the 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; September 2008; 8 pp.; In English; 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 23-25 Sep. 2008, Portsmouth, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-06NA26605

Report No.(s): AD-A518070; LLNL-CONF-405553; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518070

Inversions for regional attenuation (1/Q) of Lg are performed in two different regions. The path attenuation component of the Lg spectrum is isolated using the coda-source normalization method, which corrects the Lg spectral amplitude for the source using the stable, coda-derived source spectra. Tomographic images of Northern California agree well with one-dimensional (1-D) Lg Q estimated from five different methods. We note that there is some tendency for tomographic smoothing to increase Q relative to targeted 1-D methods. For example, in the San Francisco Bay Area, which contains high attenuation relative to the rest of the region, Q is overestimated by tilde 30. Coda-source normalized attenuation tomography is also carried out for the Yellow Sea/Korean Peninsula (YSKP), where output parameters (site, source, and path terms) are compared with those from the amplitude tomography method of Phillips et al. (2005), as well as with a new method that ties the source term to the magnitude and distance amplitude corrections (MDAC) formulation (Walter and Taylor, 2001). The source terms show similar scatter between coda-source corrected and MDAC source perturbation methods, whereas the amplitude method has the greatest correlation with estimated true-source magnitude. The coda-source better represents the source spectra compared to the estimated magnitude and could be the cause of the scatter. The similarity in the source terms between the coda-source and MDAC-linked methods shows that the latter method may approximate the effect of the former, and therefore could be useful in regions without coda-derived sources. The site terms from the MDAC-linked method correlate slightly with global Vs30 measurements. While the coda-source and amplitude ratio methods do not correlate with Vs30

measurements, they do correlate with one another, which provides confidence that the two methods are consistent.
DTIC
California; Correction; Peninsulas; Seas; Tomography

20100019414 ITT Aerospace/Communications Div., Clifton, NJ USA
The Time Keeping System for GPS Block IIR
Rawicz, H C; Epstein, M A; Rajan, J A; Dec 1992; 13 pp.; In English
Report No.(s): AD-A518814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The precision time keeping system (TKS) in the Global Positioning System (GPS), Block IIR satellites is designed to operate under severe natural and man made environmental conditions. The Block IIR TKS provides precise, autonomous time keeping for periods of up to seven months, without the intervention of the GPS Control Segment. The TKS is implemented using both linear and non-linear controls. The resulting TKS architecture uses a hybrid analog/digital phase locked loop (PLL). The paper provides details of the design and analysis of the TKS. The simulation techniques and the test bed activities used in performing the TKS design trade-offs are described. The effects of non-linear controls are analyzed using a TKS computer simulation of the PLL. The results from a hardware test bed are provided that verify desired TKS operation. The design criteria for the TKS computer simulation and the hardware test bed are indicated. The concepts for verification and testing of the TKS computer simulation and hardware test bed are presented.
DTIC
Global Positioning System; Time Measurement

20100019649 Deputy Chief of Naval Operations (Manpower Personnel and Training), Washington, DC USA
National Security and Global Climate Change
Maybee, Sean C; Jan 2008; 6 pp.; In English
Report No.(s): AD-A518858; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518858

The uncertainty, confusion, and speculation about the causes, effects, and implications of global climate change (GCC) often paralyze serious discussion by polarizing decision makers and the public into camps of believers and skeptics. The intention of this article is not to present a case for or against scientific indications of global climate change, but to consider how it would pose challenges to national security, explore options for facing those challenges, and consider roles for the USA in general and the U.S. military in particular in the many low-likelihood/high-consequence events that this threat could present. In April 2007, the Center for Naval Analyses (CNA), in coordination with 11 retired three- and four-star generals and admirals, released a report concluding that projected climate change poses a serious threat to America's national security. This article develops many of the ideas in that report by offering another way to consider the actual threats from GCC and expanding on what could be done to combat them. Specifically, it adds substance to the CNA report's third recommendation: The U.S. should commit to global partnerships that help developed nations build the capacity and resiliency to better manage climate impacts. For the purpose of this essay, national security is defined as the need to maintain the safety, prosperity, and survival of the nation-state through the use of the instruments of national power: diplomatic, informational, military, and economic. An important aspect of GCC is the fact that some of its predicted effects will, on a human time scale, be permanent. The persistence of GCC effects magnifies impact as people will be forced to adapt dramatically or to relocate permanently. For this assessment, some GCC effects identified by the Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report, are considered.
DTIC
Climate Change; Climatology; Greenhouse Effect; Responses; Security; Stability

20100019678 Sentor Technologies, Inc., Glen Allen, VA USA
The SELEX Air Purification System
Tepper, Gary; Jan 7, 2010; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-C-0164
Report No.(s): AD-A518955; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518955

A new air purification technology (SELEX) was developed and demonstrated. The SELEX system utilizes an array of electrospray wick aerosol sources for particle ionization and an electrostatic precipitator for particle collection. The particle ionization process does not produce ozone and the SELEX technology provides a unique combination of very low pressure

drop, high collection efficiency and low power. A 50 cfm breadboard prototype (SELEX II) was developed and, in addition to particle collection, incorporates the ability to inactivate collected live organisms.
DTIC
Activation (Biology); Air; Air Purification; Bacillus; Purification

20100019748 Comprehensive Nuclear Test Ban Treaty Organization, Vienna, Austria
Inclusion of a Body Wave Seismic Moment Tensor Estimator in the CTBTO/IDC Processing Suite
Le Bras, Ronan J; Hampton, Tim; Sep 2007; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519122; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519122

The experimental SELO system of the CTBTO's Preparatory Commission (LeBras et al., 2006) now includes a moment tensor (MT) and moment magnitude estimate. The SELO system rapidly detects and locates events. The effort to include further processing of large natural events, and get a better size estimate for large natural events than the mb magnitude was stated in the summer of 2005. The basic scientific software that performs the MT inversion was acquired from Y. Yagi from Tsukuba University, Japan. It performs a time-domain, long-period body-waves MT inversion soon after an event is automatically detected and located, within about 20 minutes after its occurrence. We wrote signal processing scripts to prepare the broad-band International Monitoring System (IMS) vertical seismic data for MT inversion, including deconvolution of the complete instrument responses. We included the scientific software into the Commission's environment and have now achieved its seamless integration through the web page displaying the results of the SELO bulletin. The addition of the moment tensor inversion module allows us to estimate the size and focal mechanism of the detected events, which is of interest for better characterization of the event in a limited time frame. This is important since the only available measure of the size of the earthquake for SELO events was the mb scale, which saturates for larger events. We have been able to interactively run a number of inversions and we present case examples and statistics from selected events since December 2006.
DTIC
Earthquakes; Method of Moments; Seismic Waves; Tensors

20100019772 Oregon State Univ., Corvallis, OR USA
Variability of Irradiance in the Wave Boundary Layer
Pegau, W S; Wijesekera, Hemantha W; Jan 2008; 6 pp.; In English
Contract(s)/Grant(s): N00014-06-1-0070
Report No.(s): AD-A519199; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519199

Our primary goal is improve our understanding of the role of surface waves, bubble clouds, and near surface oceanic processes on the spatial distribution of oceanic irradiance. The objectives are to: 1. Measure the variance in the oceanic light field. 2. Associate the variance in the light field with surface waves and variance in the inherent optical properties and physical properties. We are using an autonomous underwater vehicle (AUV) to make spatial measurements of physical (near surface T, C, turbulence levels), and optical (a, c, bb, Ed) fields from sensors mounted on OSU's AUV. We are working with Satlantic to also incorporate a radiance camera within the AUV. By measuring the irradiance field at high frequency we will be able to provide the optical measurements needed to evaluate models of surface effects on the irradiance field (e.g., Zaneveld et al. 2001). The optical measurements will be combined with physical measurements to improve physical models associated with surface mixing.
DTIC
Atmospheric Circulation; Boundary Layers; Irradiance; Light (Visible Radiation); Spatial Distribution; Surface Waves; Variability

20100019882 Science Applications International Corp., McLean, VA USA
Improved Infrasound Event Location
O'Brien, Michael S; Drob, Douglas P; Bowman, J R; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-06-C-0027
Report No.(s): AD-A519367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project is to improve the ability to locate infrasound events by improving the Horizontal Wind Model (HWM) used in the prediction of infrasound observables, in particular, travel time and back azimuth. Our general approach uses new wind data to develop a higher-resolution and more accurate HWM and tests the performance of Ground to Space

(G2S) specifications based on the new HWM, relative to those based on HWM-93 using a large set of ground-truth events. We assembled a preliminary data set of 180 events with which to exercise our statistical framework for testing the effect of atmospheric wind models on the accuracy of infrasound event locations. We also assembled wind data representing a 100-fold increase compared to those used for HWM-93 and incorporated these wind data into the mechanism used to generate improved HWMs. We applied this mechanism to construct a preliminary version of HWM-07, and demonstrated that this preliminary model displays some important features that were missing from HWM-93, such as wind velocities of up to 70 m/s at an altitude of 110 km. We created an efficient mechanism to trace rays through atmospheric models for a large suite of infrasound source-station pairs. Initially, we have based our generation of travel-time and back-azimuth predictions on the HARPA 3-D ray-tracing programs. We refined the statistical framework for testing the effect of atmospheric wind models on predictions and applied it to first arrivals for a preliminary data set of 251 source-receiver pairs from 108 events to evaluate and compare predictions made against the existing, baseline atmospheric specifications for our study, G2S and HWM-93/MSISE-00, on which it is based, above 50 km. As expected, we find that G2S more often and more accurately predicts stratospheric first arrival times and back azimuths, whereas the two models are both equally poor at predicting thermospheric arrival times and back azimuths.
DTIC

Atmospheric Models; Computer Programs; Computerized Simulation; Ground Truth; Incoherent Scattering; Infrasonic Frequencies; Mass Spectroscopy; Position (Location); Thermosphere

20100019885 Weston Geophysical Corp., Lexington, MA USA

Regional P Coda for Stable Estimates of Body Wave Magnitude: Extending the Ms:mb Discriminant to Smaller Events

Mayeda, Kevin; Bonner, Jessie; Sep 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0027

Report No.(s): AD-A519372; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The most successful teleseismic discriminant is Ms:mb, and many studies are underway to try to extend surface wave magnitude (Ms) estimation to regional distances. A problem that is encountered at regional distances and small magnitudes is how to estimate mb so that the Ms:mb discriminant is meaningful and consistent with teleseismic measures. Over the past several years, a regional S-coda wave methodology has been developed that provides for the lowest variance estimate of the seismic source spectrum. Thus, regional MW and mb estimates derived from Sn and Lg coda are very stable, even when only a single station is used. However, these mb's are inherently biased for earthquakes because they are an S-based measurement, and explosions are relatively depleted in S-waves. Previous research projects have used region-specific mb scales based on direct measurements of Pn and Pg to improve the Ms:mb discrimination, even though the mb estimates often had a large variance. In our preliminary research, we have found that P-coda envelopes for both explosions and earthquakes can be obtained for events from both the Nevada Test Site (NTS) and Novaya Zemlya (NZ) regions without bias. Our next step at NTS will be to derive path corrections, similar to the approach of Mayeda et al. (2003) for Lg-coda. We will compare inter-station scatter of distance-corrected amplitudes as a function of window length. This will provide an empirical measure of error based on window length for each frequency band. For each frequency band, we will regress our coda envelope amplitudes against regional and teleseismic estimates of mb (e.g., mb(Pn), mb(P)) to determine which band provides the lowest variance. This will yield slope and intercept values for each frequency band. We will then derive mb(Pn) and mb(P) (following Denny et al., 1989) to compare against mb(P-coda) to assess performance at the network and single-station level.
DTIC

Discriminant Analysis (Statistics); Estimates; Frequencies; P Waves; Seismic Waves; Seismology; Test Facilities

20100020198 Saskatchewan Univ., Saskatoon, Saskatchewan Canada

Frequency-Dependent Short-Period Explosion Coda Amplitudes in Northern Eurasia

Morozov, Igor B.; Zhang, Chaoying; Morozova, Elena A.; September 2007; 13 pp.; In English

Contract(s)/Grant(s): DE-FC52-05NA26609

Report No.(s): AD-A519292; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Travel-time and magnitude-yield calibration of Northern Eurasia, which is largely aseismic, can be improved by using the large chemical and peaceful nuclear explosion (PNE) seismic data sets acquired by the Soviet deep seismic sounding (DSS) program. Eleven major data sets of this program have recently been digitized and have become available to nuclear test monitoring research. Although the PNEs have been already used in several monitoring studies, the chemical-explosions data sets are still incompletely explored. In the present study, we use inversion and numerical modeling to analyze the coda

amplitude parameters and P-wave travel times from numerous DSS explosions, which could lead to a detailed empirical mapping of seismic properties within northern Eurasia.
DTIC
Asia; Europe; Explosions; Frequencies

20100020224 Silicon Audio, LLC, Austin, TX USA
Micro-Seismometers via Advanced Mesoscale Fabrication
Hall, Neal A.; September 2008; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-FG02-08ER85106
Report No.(s): AD-A518793; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518793

The Department of Energy's National Nuclear Security Administration (DOE/NNSA) seeks revolutionary innovations with respect to miniature seismic sensors for the monitoring of nuclear detonations. Specifically, the performance specifications are to be consistent with those obtainable by only an elite few products available today, but with orders of magnitude reduction in size, weight, power, and cost. The proposed innovation calls upon several advanced fabrication methods and read-out technologies being pioneered by Silicon Audio, including the combination of silicon microfabrication, advanced meso-scale fabrication and assembly, and the use of advanced photonics-based displacement/motion-detection methods. Successful implementation will result in a commercial product roughly the size of a common USB flash drive with the ability to address advanced national security needs of the DOE/NNSA. Additional commercial market sectors include military/defense, scientific/instrumentation, oil and gas exploration, and inertial navigation.
DTIC
Detonation; Fabrication; Mesoscale Phenomena; Nuclear Explosions; Seismographs

20100020261 Lawrence Livermore National Lab., Livermore, CA USA
Regional Analysis of Lg Attenuation: Comparison of 1-D Methods in Northern California and Application to the Yellow Sea/Korean Peninsula
Ford, Sean R.; Dreger, Douglas S.; Mayeda, Kevin M.; Walter, William R.; Malagnini, Luca; Phillips, W. S.; September 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-FC52-05NA26605/BAA05-22
Report No.(s): AD-A518897; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518897

The measurement of regional attenuation Q(1) can produce method dependent results. The discrepancies among methods are due to differing parameterizations (e.g., geometrical spreading rates), employed data sets (e.g., choice of path lengths and sources), and methodologies themselves (e.g., measurement in the frequency or time domain). We apply the coda normalization (CN), two-station (TS), reverse two-station (RTS), source-pair/receiver-pair (SPRP), and the new coda-source normalization (CS) methods to measure Q of the regional phase, Lg (Q(Lg)), and its power-law dependence on frequency of the form Q(Of) with controlled parameterization in the well-studied region of northern California using a high-quality data set from the Berkeley Digital Seismic Network. We test the sensitivity of each method to changes in geometrical spreading, Lg frequency bandwidth, the distance range of data, and the Lg measurement window. For a given method, there are significant differences in the power-law parameters, Q(o) and eta, due to perturbations in the parameterization when evaluated using a conservative pairwise comparison. The CN method is affected most by changes in the distance range, which is most probably due to its fixed coda measurement window. Since, the CS method is best used to calculate the total path attenuation, it is very sensitive to the geometrical spreading assumption. The TS method is most sensitive to the frequency bandwidth, which may be due to its incomplete extraction of the site term. The RTS method is insensitive to parameterization choice, whereas the SPRP method as implemented here in the time-domain for a single path has great error in the power-law model parameters and eta is greatly affected by changes in the method parameterization. When presenting results for a given method it is best to calculate Q(of) for multiple parameterizations using some a priori distribution.
DTIC
Attenuation; California; Korea; Mathematical Models; Peninsulas; Seas; Seismic Waves

20100020262 Lawrence Livermore National Lab., Livermore, CA USA

Considerations of the Use of 3-D Geophysical Models to Predict Test Ban Monitoring Observables

Harris, David B.; Zucca, John J.; McCallen, David; Pasyanos, Michael E.; Flanagan, Megan P.; Myers, Stephen C.; Walter, William R.; Rodgers, Arthur J.; Harben, Phil E.; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): AD-A518893; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518893

The use of 3-D geophysical models to predict nuclear test ban monitoring observables (phase travel times, amplitudes, dispersion, etc.) is widely anticipated to provide improvements in the basic seismic monitoring functions of detection, association, location, discrimination and yield estimation. A number of questions arise when contemplating a transition from 1-D, 2-D and 2.5-D models to constructing and using 3-D models, among them: (1) Can a 3-D geophysical model or a collection of 3-D models provide measurably improved predictions of seismic monitoring observables over existing 1-D models, or 2-D and 2 1/2-D models currently under development? (2) Is a single model that can predict all observables achievable, or must separate models be devised for each observable? How should joint inversion of disparate observable data be performed, if required?; (3) What are the options for model representation? Are multi-resolution models essential? How does representation affect the accuracy and speed of observable predictions?; (4) How should model uncertainty be estimated, represented, and how should it be used? Are stochastic models desirable?; (5) What data types should be used to construct the models? What quality control regime should be established?; (6) How will 3-D models be used in operations? Will significant improvements in the basic monitoring functions result from the use of 3-D models? Will the calculation of observables through 3-D models be fast enough for real-time use or must a strategy of pre-computation be employed?; (7) What are the theoretical limits to 3-D model development (resolution, uncertainty) and performance in predicting monitoring observables? How closely can those limits be approached with projected data availability, station distribution and inverse methods?; (8) What priorities should be placed on the acquisition of event ground truth information, deployment of new stations, development of new inverse techniques.

DTIC

Geophysics; Ground Truth; Mathematical Models; Nuclear Explosions; Three Dimensional Models

20100020266 Lawrence Livermore National Lab., Livermore, CA USA

Extension of the Caucasus Seismic Information Network Study into Central Asia

Martin, Randolph J.; Krasovec, Mary L.; Romer, Spring A.; Foxall, William; Vergino, Eileen S.; Gulen, Levent; Toksoz, M. Nafi; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC52-04NA25612

Report No.(s): AD-A518884; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518884

The Central Asian Seismic Research Initiative (CASRI) is an extension of the Caucasus Seismic Information Network (CauSIN). Both projects seek to build knowledge bases of geological, geophysical, and seismic information in their respective regions and to use crustal modeling techniques to create a combined model of the regions to aid in seismic monitoring. Catalog and phase arrival data from local networks in the CASRI region (Kazakhstan, Kyrgyzstan, Tajikistan, and Uzbekistan) have been collected. The historical catalog contains nearly 11,000 events from 500 AD through the present. The modern catalog of the region includes 469 events from 1991 to 2005. Participants in the project are validating data quality and preparing phase arrival tables. Because these data have never before been shared with the world-wide seismic community, care is being taken to use consistent station naming and descriptions for each station. The phase arrival data from Kazakhstan includes 2,991 seismic phases for 71 events in Kazakhstan and 2,257 phases for events in other countries in the region. Kyrgyzstan's phase data include 2,500 arrivals picked from roughly half of the events in the country; local scientists are continuing to make picks from the rest of their data and will eventually expand to pick times from events in the other CASRI countries. Other new acquisitions include newly released explosion data in paper print-out format, which provide ground truth and are invaluable to crustal tomography and validation of earth models. These data include 600 records from 177 events and 33 stations. Event-station separations range from 450 to 2,500 km. These data are in the process of being digitized. This seismic travel time data, combined with the available geophysical and tectonic information, will be used for the tomographic modeling of the CASRI region.

DTIC

Asia; Caucasus Mountains (U.S.S.R.); Explosions; Geophysics; Ground Truth; Seismic Waves; Tomography

20100020267 Lawrence Livermore National Lab., Livermore, CA USA; Nevada Univ., Reno, NV, USA

Numerical Experiments Investigating the Source of Explosion S-Waves

Myers, Stephen C.; Wagoner, Jeffrey L.; Larsen, Shawn C.; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W-7405-ENG-48/ROA02-08; DE-FC03-02SF22656

Report No.(s): AD-A518877; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518877

In this study we use validated explosion simulations to investigate the locations at which explosion S-waves originate. Several mechanisms for generating S-waves from an explosion source have been put forward. These mechanisms include tectonic release, non-symmetrical source effects, non-linear source effects, conversion of P-waves to S-waves off the free surface, and scattering of near-source Rayleigh waves. Each of these mechanisms is physically sound, and each mechanism likely contributes to the observed S-wave field. Identifying where explosion S-waves originate provides an important constraint on the contribution of each S-wave mechanism. The simulations in this study are based on the well-recorded 1993 Nonproliferation experiment (NPE) (chemical kiloton). A regional 3-dimensional model surrounding the NPE is validated by first extracting vertical cross-sections cutting through the NPE source and stations at which the NPE was recorded. We then generate synthetic seismograms using a 2-dimensional finite difference calculation for each event-station path. Good agreement between synthetic and observed seismograms provides confidence that the model and simulations are reasonably accurate. The origin of S-waves is determined through both analysis of the simulated wavefield evolution and using the timereversal method to refocus far-field S-waves back to their origin. Preliminary results suggest that the primary S-wave pulse originates near the free surface and at high-impedance geologic interfaces that are close to the explosion. These results suggest that scattering can account for much of the observed S-wave energy radiated from the NPE explosion.

DTIC

Explosions; Numerical Analysis; P Waves; Rayleigh Waves; S Waves; Wave Fronts

20100020268 Lawrence Livermore National Lab., Livermore, CA USA

Developing and Exploiting a Unique Seismic Data Set from South African Gold Mines for Source Characterization and Wave Propagation

Nyblade, Andrew A.; Walter, William R.; Gok, Rengin; Linzer, Lindsay; Durrheim, Ray; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-06NA27320; W-7405-ENG-48

Report No.(s): AD-A518876; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518876

In this project, we are developing and exploiting a unique seismic data set to address the characteristics of small seismic events and the associated seismic signals observed at local (200 km) and regional (2000 km) distances. The data set is being developed using mining-induced events from 3 deep gold mines in South Africa recorded on in-mine networks (1 km) comprised of hundreds of high-frequency sensors, a network of broadband seismic stations installed as part of this project at the surface around the mines (1 - 50 km), and a network of existing broadband seismic stations at local and regional distances (50 - 1000 km) from the mines. The final data set will contain: (1) events spanning 5 orders of magnitude (M from approximately -1 to 3) well recorded at a wide range of local and regional distances, (2) events from a range of source depths (0 - 4 km), and (3) events from a variety of source types correlated with in-mine information such as pillar collapse and shear failure. Six months of data has been collected so far from the broadband seismic networks, and three months from the in-mine networks. We are exploiting the data set to improve U.S. operational capabilities to monitor for low-yield nuclear tests by analyzing the mining-induced events in a number of ways. We are gathering and analyzing events with M 2.5, as well as some selected smaller events, including point explosions (mine blasts), mine-related stress release, mining activities, and shallow earthquakes. We are creating cataloged information on origin times and locations ground truth 0 (GT0), source parameters, focal mechanisms, coda-derived source spectra, coda magnitudes, local-to-regional phase propagation characteristics, relative P and S excitation, source apparent stress variation, and local-to-regional body-wave amplitude ratios that can discriminate between the different source categories.

DTIC

Africa; Characterization; Depth; Gold; Ground Truth; Republic of South Africa; Seismic Waves; Wave Propagation

20100020273 Lawrence Livermore National Lab., Livermore, CA USA

Empirical Observations of Earthquake-Explosion Discrimination Using P/S Ratios and Implications for the Sources of Explosion S-Waves

Walter, William R.; Matzel, Eric; Pasyanos, Michael E.; Harris, David B.; Gok, Rengin; Ford, Sean R.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; September 2007, pp. 684-693; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): AD-A519669; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We continue exploring methodologies to improve earthquake-explosion discrimination using regional amplitude ratios such as P/S (ratio of P- and/or S-wave energy). The earliest simple source models predicted P/S wave amplitudes for explosions should be much larger than for earthquakes across the body wave spectrum. However empirical observations show the separation of explosions from earthquakes using regional P/S amplitudes is strongly frequency dependent, with relatively poor separation at low frequencies (tilde 1 Hz) and relatively good separation at high frequencies (greater than tilde 3 Hz). We demonstrate this using closely located pairs of earthquakes and explosions recorded on common, publicly available stations at test sites around the world (e.g., Nevada, Lop Nor, Novaya Zemlya, Semipalatinsk, India, Pakistan, and North Korea). We show this pattern appears to have little dependence on the point source variability revealed by longer period surface wave modeling. For example regional waveform modeling shows strong tectonic release from the May 1998 India test in contrast with very little tectonic release in the recent North Korea test, but the P/S discrimination behavior is similar in both events, using the limited regional data available. While accepted explosion P-wave models have been available for many years, the frequency behavior of the P/S discriminant has inspired a variety of competing models to explain how explosions generate S-waves. We briefly review some of these models in the context of the P/S discriminant observations. One hypothesis is that S-waves are generated mainly from conversion of P-waves and surface waves, so S-waves from explosions can be predicted from the P-wave models via a frequency dependent transfer function. A different hypothesis is that significant generation of S-waves comes from the CLVD (compensated linear vector dipole) component created by spall above the explosion.

DTIC

Earthquakes; Explosions; S Waves

20100020274 Saint Louis Univ., MO USA; Lawrence Livermore National Lab., Livermore, CA, USA

Seismic Source and Path Calibration in the Korean Peninsula, Yellow Sea, and Northeast China

Herrmann, Robert B.; Walter, William R.; Pasyanos, Michael E.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; September 2007, pp. 592-601; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-04NA25539; W-7405-ENG-48

Report No.(s): AD-A519666; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two significant seismic events were analyzed using the crustal velocity model developed under this contract. The M(w) = 4.55 Korean earthquake of January 20, 2007, occurred in the Republic of Korea on land and within the dense digital seismic network. Using P-wave arrivals from 60 broadband, short-period and acceleration stations, the event occurred at 37.68N, 128.58E at a depth of 7.5 km at 20070120115653.8. Source inversion was performed using the accelerometer recordings in the 0.05-0.20 Hz band and the broadband data in the 0.02-0.10 Hz band, with identical focal mechanisms and source depths of 9 and 11 km, respectively. This is the largest event on land in South Korea since the Mw 4.7 event on December 13, 1996. Forward modeling of the waveforms at INCN and MDJ indicates the ability of the current model to match observations on the Korean Peninsula and the effect of significant pulse shape modification for paths that partially cross the Sea of Japan. The results of using the local network data provide a ground truth point for other studies analyzing seismic events on the peninsula. The isotropic seismic moment of the October 9, 2006, North Korean explosion was estimated from the Rayleigh-wave spectral amplitudes observed at MDJ and INCN. Very little Love wave signal was observed, indicating weak tectonic release. The explosion yield was investigated using the Denny and Johnson (1991) model relating yield to the observed isotropic moment as a function of depth of burial and material properties. Sensitivity analysis highlights the strong effect of the assumed velocity and density structure in the upper kilometer of the Earth and the assumed depth of burial on the estimated yield. The crustal velocity model developed under this contract provides strong constraints on the expected shear-wave velocities in the shallow parts of the crust.

DTIC

Calibrating; China; Peninsulas; Seas; Seismology

20100020294 Pennsylvania State Univ., University Park, PA USA

Ground Truth, Magnitude Calibration and Regional Phase Propagation and Detection in the Middle East and Horn of Africa

Nyblade, Andrew A.; Brazier, Richard A.; Adams, Aubreya; Park, Yungcheol; Rodgers, Arthur J.; Al-Amri, Abdullah; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-05NA26602; W-7405-ENG-48

Report No.(s): AD-A519779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this project, we are exploiting several seismic data sets to improve U.S. operational capabilities to monitor for low yield nuclear tests across the Middle East (including the Iranian Plateau, Zagros Mountains, Arabian Peninsula, Turkish Plateau, Gulf of Aqaba, Dead Sea Rift) and the Horn of Africa (including the northern part of the East African Rift, Afar Depression, southern Red Sea and Gulf of Aden). The data sets are being used to perform three related tasks. (1) We are determining moment tensors, moment magnitudes and source depths for regional events in the magnitude 3.0 to 6.0 range. (2) These events are being used to characterize high-frequency (0.5-16 Hz) regional phase attenuation and detection thresholds, especially from events in Iran recorded at stations across the Arabian Peninsula. (3) We are collecting location ground truth at GT5 (local) and GT20 (regional) levels for seismic events with M is greater than 2.5, including source geometry information and source depths. Towards meeting these objectives, seismograms from earthquakes in the Zagros Mountains recorded at regional distances have been inverted for moment tensors, which have then been used to create synthetic seismograms to determine the source depths of the earthquakes via waveform matching. The source depths have been confirmed by modeling teleseismic depth phases recorded on Global Seismographic Network (GSN) and International Monitoring System (IMS) stations. Early studies of the distribution of seismicity in the Zagros region found evidence for earthquakes in the upper mantle. But subsequent relocations of teleseismic earthquakes suggest that source depths are generally much shallower, lying mainly within the upper crust. All of the regional events studied so far nucleated within the upper crust, and most of the events have thrust mechanisms.

DTIC

Africa; Calibrating; Ground Truth; Middle East

20100020296 Massachusetts Inst. of Tech., Cambridge, MA USA

Modeling Travel-Time Correlations Based on Sensitivity Kernels and Correlated Velocity Anomalies

Rodi, William L.; Myers, Stephen C.; September 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-05NA26603; W-7405-ENG-48

Report No.(s): AD-A519772; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A major contributor to the error in regional and teleseismic event locations is travel-time prediction error, attributable to velocity anomalies in the real Earth that are not represented in the reference Earth model an event locator uses for travel-time calculation. The prediction errors at two stations will, in general, be correlated depending on the spatial coherency of the velocity anomalies compared to the distance between the stations. The motivation for this project is the observation by previous workers that large event location errors can be induced when prediction error correlations are ignored and the observing network of stations is far from uniform. Recently, event location algorithms have been generalized to accept a non-diagonal covariance matrix for data errors as a mechanism for accommodating correlated errors in travel-time predictions. Our project is addressing what to input for the covariance matrix, based on considerations of seismic wave propagation and the statistical characterization of the Earth's velocity heterogeneity. Specifically, we are developing numerical algorithms that generate a travel-time covariance matrix for a network of stations, as a function of the event location, by integrating a velocity covariance function, as defined in geostatistical analysis, with the travel-time sensitivity kernels appropriate for the event-station paths. This paper describes two alternative techniques for performing this calculation, which are compared in a numerical example. A second example of our approach investigates the variation of travel-time variances and correlations over regional and near-teleseismic distances, computed using ray sensitivities for a 1D reference Earth model. This example demonstrates a strong dependence on ray parameter that agrees qualitatively with empirical observations.

DTIC

Anomalies; Correlation; Sensitivity

20100020305 Wisconsin Univ., Madison, WI USA

High-Resolution Three-Dimensional Seismic Imaging of The Baikal and Amur Regions of Eastern Russia

Zhang, Haijiang; Mackey, Kevin G.; Fujita, Kazuya; Steck, Lee K.; Rowe, Charlotte A.; Thurber, Clifford H.; Roecker, Steven; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007; 11 pp.; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-06NA27325

Report No.(s): AD-A519678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Eastern Russia is composed of a series of allochthonous terranes which have accreted to the Precambrian Siberian (North Asian) craton. This study is focused on the southern part (Baikal and Amur regions), where accretionary terranes form a suture zone between the Siberian and North China cratons, which is being exploited by the present-day boundary between the Eurasian plate and the Amur block. The complexities of accretion and subsequent intracontinental deformation likely result in a highly heterogeneous crust, a broad zone of deformation, and the formation of small blocks within the ancient suture and present-day plate boundary zones. We assembled catalog picks from 13000 events and 100 stations for the Baikal and Amur regions in the period of 1970 to 2005. Using the double-difference tomography method (Zhang and Thurber, 2003, 2006), our study for the first time provides a detailed seismic velocity model of the crust and upper mantle for this complicated area. The original sources for the Siberia database vary from published Siberia-wide Russian earthquake bulletins to unpublished bulletins of regional network operators. It is very likely that there still exist some arrival time pick outliers in the assembled data. Quality assessment of picks and event-pair differential times is a critical aspect for achieving a high-quality velocity model for the Baikal and Amur regions. In our study we identify and remove outliers in catalog picks using event-pair differential times based on the fact that travel times from two nearby events should be consistent. In our data set, many arrivals at larger distances are identified in the catalog as Pg or Sg phases, which are often observable because of their relatively large amplitudes.

DTIC

High Resolution; Imaging Techniques; Russian Federation; Seismology

20100020306 Michigan State Univ., East Lansing, MI USA

Seismic Characterization of Northeast Asia

Mackey, Kevin G.; Hartse, Hans E.; Steck, Lee K.; Stead, Richard J.; Rowe, Charlotte A.; Fujita, Kazuya; Gutirrez, Luiza; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007, pp. 123-132; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-2004NA25540; DE-AC52-06NA25396

Report No.(s): AD-A519472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our project of seismic characterization of northeast Asia continues on a multi-faceted approach concentrating on eastern Russia. The field work aspects of the project have included temporary station deployments, new permanent seismic station installations, and calibration of existing digital stations. Seismic station deployments include a 5 station temporary deployment in the Stanovoi Range in southern Yakutia/northern Amur region and two stations deployed in the vicinity of Yakutsk. The station deployments in the Stanovoi Range investigated the connection between a young volcanic field and a large cluster of poorly located historical seismicity and were the first ever seismic deployments in that region of eastern Russia. The volcanic field appears to be aseismic although surrounding areas were found to be very active, with more than 20 locatable local events per day recorded. We also mapped large scale active thrust faults in the region, which combined with observed seismicity will help us understand expected seismicity patterns, location quality, and tectonic models. We also are working on establishing 2 permanent stations in the Amur region and continue to work on station calibrations, with recent data acquired at Stekolnyi. Our Siberia database enhancements for this past year include (1) addition of new earthquakes and explosions and associated phase data, amplitudes, etc., primarily from the Irkutsk, Yakutsk, and Magadan networks for the years 1999-2006; (2) additions of amplitude data primarily from the Chukotka and Amur regions to aid amplitude tomography efforts; and (3) general quality control efforts primarily targeting unmerged, multi-author origins, the resolution of duplicated arrival information, and the inclusion of USA Geological Survey Earthquake Data Reports (USGS EDR) and International Seismological Centre (ISC) magnitudes for larger events where Russian network operators did not report a K-class or a magnitude estimate.

DTIC

Asia; Seismology

20100020313 Los Alamos National Lab., NM USA

Infrasound Signals as Basis for Event Discriminants

Whitaker, Rodney W.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Confrence; September 2007, pp. 905-913; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-AC52-06NA25396

Report No.(s): AD-A519418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Herein we summarize the first several months' effort in this research project of calculating the near-field infrasound signals generated by ground motion sources such as underground tests and earthquakes. Our approach is a direct application of the Rayleigh integral to the ground motion acceleration as seen by an observer at altitude near the source. The numerical integration is straightforward; however, the specification of the acceleration time history may be more difficult. Results of such calculations can, with good ground motion models for underground tests and earthquakes, be used to look for differences in the near-field infrasound signals that would be the basis for discriminants. So far, the work has concentrated on getting basic codes in place and on modeling underground test signals, which will be the emphasis of this contribution. There are 34 events for which model ground motion parameters were derived, earlier by others, from the ground motion data. We now have access to the Nevada Test Site (NTS) ground motion database. This can help in improving ground motion models for underground tests. Another new development was the successful application of a two-dimensional time-domain finite-difference code to this problem. The code was run with a time dependent velocity boundary condition and to a problem time of 40 seconds showing the acoustic signal in the 12 km by 12 km domain. Results from this code can be used to benchmark other codes. Another planned use for this near-field modeling work is to provide realistic initial conditions for long-range acoustic propagation codes.

DTIC

Earth Movements; Infrasonic Frequencies; Signal Transmission; Sound Waves

20100020317 California Univ., San Diego, La Jolla, CA USA

Discrimination Capability for Mining Events in the Altai-Sayan Region of Russia and the Western USA

Arrowsmith, Marie D.; Arrowsmith, Stephen J.; Stump, Brian; Hedlin, Michael A.; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-03NA99510; DE-FC52-03NA9951

Report No.(s): AD-A519381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As more seismic and infrasound stations and arrays are deployed for nuclear explosion monitoring, catalogs of seismic events contain not only earthquakes, but many types of anthropogenic sources. Mining events are commonly recorded at regional distances by these stations, with the possibility of misidentification, (e.g., a legitimate mining explosion mistaken as nuclear). Additionally, a nuclear explosion could potentially be embedded in a mining explosion and be missed. Different discriminants have been utilized to separate mining events from natural seismicity with varying degrees of success. In this paper we present results of ongoing efforts to test several discriminants (amplitude ratios, time varying spectral analysis, time-of-day analysis, and infrasound) for two active mining regions: the Powder River Basin (PRB) in the western USA and the Altai-Sayan (AS) in Russia. The first phase of work on this contract has focused on using seismic and infrasound data in the PRB as a test bed for developing and assessing different mining explosion discriminants. This work is outlined in detail by Arrowsmith et al. (2006a, 2007). The results obtained indicate that phase amplitude discriminants, which have been found to be successful in separating earthquakes from nuclear explosions, do not separate earthquakes and mining explosions in this region, probably due to a combination of source and path effects. However, a time-varying spectral discriminant developed as part of this project was very successful at identifying the largest types of mining explosions (cast blasts). We also identified infrasound signals from large mining explosions in this region, suggesting good potential for the use of infrasound as an additional discriminant in this region when winds are favorable.

DTIC

Discriminant Analysis (Statistics); Explosions; Infrasonic Frequencies; Mining; Russian Federation; Seismic Waves; United States

20100020318 California Univ., Berkeley, CA USA

Developing Multiple-Frequency Discriminants for Use with Regional Coda-Amplitude Measurements

Pitarka, Arben; Mayeda, Kevin M.; Collins, Nancy R.; September 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC52-04NA25545

Report No.(s): AD-A519380; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper investigates the feasibility of employing local to near-regional coda-wave amplitude measurements, in multiple, narrow bands, for the purpose of discriminating small seismic events. The motivation comes from previous studies that have shown that regional, single-station coda-magnitude estimates are more stable and accurate than any direct phase measure to date (e.g., Mayeda et al., 2003). Typically, the source amplitude estimates derived from the coda have interstation variances on the order of 0.07 log amplitude units; hence, the method is excellent for regions with sparse station coverage. The method has been thoroughly tested over large geographic regions spanning both local and regional distances for the purpose of magnitude estimation. In terms of discrimination, only a preliminary study using coda waves was performed on Nevada Test Site (NTS) explosions and earthquakes in the study by Walter et al., (1995). Since this time, however, no additional studies have been conducted, in spite of the coda's successful application for moment magnitude (MW) estimates in the broad areas of Eurasia and the Middle East. Due to the nature of the scattered energy comprising the coda, path and azimuthal source-radiation effects are averaged over, making coda amplitudes insensitive to local structure, in sharp contrast to direct regional phases such as Pn, Pg, and Lg. Calibrated with respect to seismic moment (M0) or MW, coda-derived source spectra provide a means to obtain moment estimates from seismograms of smaller or more distant events that cannot be analyzed with conventional waveform or spectral source-inversion techniques because of signal-to-noise limitations. Tying coda magnitude to Mw also provides a physical measure of event size that is unbiased and therefore transportable.

DTIC

Discriminant Analysis (Statistics); Frequencies; Magnitude; Seismic Waves; Seismology; Waveforms

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20100018386 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Direct Linearization and Adjoint Approaches to Evaluation of Atmospheric Weighting Functions and Surface Partial Derivatives: General Principles, Synergy and Areas of Application

Ustino, Eugene A.; April 5, 2006; 17 pp.; In English; 26th European Geosciences Union General Assembly, 2-7 Apr. 2006, Vienna, Austria, Austria; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41553

This slide presentation reviews the observable radiances as functions of atmospheric parameters and of surface parameters; the mathematics of atmospheric weighting functions (WFs) and surface partial derivatives (PDs) are presented; and the equation of the forward radiative transfer (RT) problem is presented. For non-scattering atmospheres this can be done analytically, and all WFs and PDs can be computed analytically using the direct linearization approach. For scattering atmospheres, in general case, the solution of the forward RT problem can be obtained only numerically, but we need only two numerical solutions: one of the forward RT problem and one of the adjoint RT problem to compute all WFs and PDs we can think of. In this presentation we discuss applications of both the linearization and adjoint approaches

CASI

Linearization; Meteorological Parameters; Radiance; Radiative Transfer; Earth Atmosphere; Atmospheric Scattering; Light Scattering

20100018394 Department of Energy, Germantown, MD, USA

Atmospheric Radiation Measurement Program Climate Research Facility Operations, Quarterly Report, April 1 - June 30, 2007

June 2007; 6 pp.; In English

Report No.(s): DE2009-966778; DOE/SC-ARM/P-07-010; No Copyright; Avail.: Department of Energy Information Bridge

Table 1 shows the accumulated maximum operation time (planned uptime), the actual hours of operation, and the variance (unplanned downtime) for the period April 1 through June 30, 2007, for the fixed sites only. The AMF has been deployed to Germany and is operational this quarter. The third quarter comprises a total of 2,184 hours. Although the average exceeded

our goal this quarter, there were cash flow issues resulting from Continuing Resolution early in the period that did not allow for timely instrument repairs that kept our statistics lower than past quarters at all sites. The low NSA numbers resulted from missing MFRSR data this spring that appears to be recoverable but not available at the Archive at the time of this report.
NTIS
Atmospheric Chemistry; Atmospheric Radiation; Climate; Data Processing; Radiation Measurement; Research Facilities

20100018420 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Aura MLS Cloud Measurements: First-Year Results
Jiang, Jonathan H.; Wu, Dong L.; August 2, 2005; 15 pp.; In English; International Association of Meteorology and Atmospheric Sciences (IAMAS), 2-11 Aug. 2005, Beijing, Chinga, China; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41521

Aura MLS provides the first vertical upper tropospheric cloud profiling from space, enabling global survey of the vertical structure of cloud systems, with seasonal and geographical variations, needed to evaluate the way clouds are parameterized in global models, thereby contributing to the understanding of cloud-climate feedbacks, and improved weather and climate predictions. The vertical structure of cloud systems is fundamentally important for understanding how clouds affect both their regional and large-scale atmospheric and radiative environments. The regional cloud profiles provide a critical tests of important parameterizations that enable the calculation of radiative flux profiles and heating rates throughout the atmospheric column, which in turn also regulates the water and energy cycles in the upper troposphere
Author
Annual Variations; Atmospheric Composition; Climate; Troposphere; Cycles

20100018496 Congressional Budget Office, Washington, DC, USA
Federal Climate Change Programs: Funding History and Policy Issues
March 2010; 31 pp.; In English
Report No.(s): PB2010-108267; No Copyright; Avail.: CASI: A03, Hardcopy

In recent years, the federal government has allocated several billion dollars annually for projects to expand the understanding of climate change or to reduce carbon dioxide and other greenhouse-gas (GHG) emissions. Most of that spending is done by the Department of Energy (DOE) and by the National Aeronautics and Space Administration (NASA), although a dozen other federal agencies also participate. The work is coordinated by committees in the Executive Office of the President. Successive Administrations have tracked the funding of climate change programs and the cost of tax incentives related to climate change through what is sometimes called the 'climate change budget.' That budget typically has included federal efforts in several categories: Technology programs that develop, demonstrate, and deploy new products or processes to reduce GHG emissions; Scientific research directed toward explaining the processes of climate change and monitoring the global climate; Assistance to other countries as they work to reduce GHG emissions; and Tax incentives that encourage businesses and households to adopt technologies that curtail the use of fossil fuels and reduce GHG emissions.
NTIS
Air Pollution; Climate Change; Global Warming; Greenhouse Effect; Policies; Pollution Control

20100018506 Agency for International Development, Washington, DC, USA
Global Climate Change Program: Latin America and the Carribean
April 2007; 6 pp.; In English
Report No.(s): PB2010-107610; No Copyright; Avail.: National Technical Information Service (NTIS)

The Latin America and the Caribbean (LAC) region boasts abundant water, tremendous biological diversity, and approximately half of the tropical forests in the world. However, population growth, deforestation, urban expansion, and pollution threaten the regions environment and raise the potential for conflict. USAIDs environment programs in the LAC region seek to mitigate these challenges, creating the potential for long-term economic benefit from the use of the regions natural resources. USAIDs Global Climate Change Program is active bilaterally in countries such as Bolivia, Brazil, Ecuador, Mexico, Paraguay, and Peru, as well as throughout the Central American region.
NTIS
Central America; Climate Change; Climatology; South America; Caribbean Region; Tropical Regions; Rain Forests; Environment Effects

20100018508 Agency for International Development, Washington, DC, USA
Global Climate Change Program: Asia and the Near East
April 2007; 6 pp.; In English
Report No.(s): PB2010-107609; No Copyright; Avail.: National Technical Information Service (NTIS)

USAIDs Global Climate Change Program is working with key countries to promote clean energy, reduce greenhouse gas emissions and deforestation, and increase the resilience of vulnerable populations to climatic changes. The Program works bilaterally in countries such as Afghanistan, Bangladesh, India, Indonesia, Nepal, and the Philippines; and through two regional programs, the South Asia Regional Initiative for Energy (SARI/Energy) and the Regional Development Mission/Asia (RDM/A).
NTIS
Asia; Climate Change; Climatology; Environment Effects; Man Environment Interactions

20100018512 National Academy of Sciences - National Research Council, Washington, DC, USA
Understanding Climate's Influence on Human Evolution
January 2010; 127 pp.; In English
Contract(s)/Grant(s): EAR-0625247
Report No.(s): PB2010-107926; No Copyright; Avail.: National Technical Information Service (NTIS)

The hominin fossil record documents a history of critical evolutionary events that have ultimately shaped and defined what it means to be human, including the origins of bipedalism; the emergence of our genus Homo; the first use of stone tools; increases in brain size; and the emergence of Homo sapiens, tools, and culture. The geological record suggests that some of these evolutionary events were coincident with substantial changes in African and Eurasian climate, raising the intriguing possibility that key junctures in human evolution and behavioral development may have been affected or controlled by the environmental characteristics of the areas where hominins evolved. However, with both a sparse hominin fossil record and an incomplete understanding of past climates, the particular effect of the environment on hominin evolution remains speculative. This presents an opportunity for exciting and fundamental scientific research to improve our understanding of how climate may have helped to shape our species, and thereby to shed light on the evolutionary forces that made us distinctively human.
NTIS
Biological Evolution; Climate; Climate Change; Human Beings

20100018720 Naval Research Lab., Bay Saint Louis, MS USA
Measurements of Ambient Noise During Extreme Wind Conditions in the Gulf of Mexico
Newcomb, Joal J; Snyder, Mark A; Hillstrom, Wesley R; Goodman, Ralph; Jan 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517968; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517968

The Littoral Acoustic Demonstration Center (LADC) deployed three Environmental Acoustic Recording System (EARS) buoys in the northern Gulf of Mexico during the summer of 2002 (LADC 02). The hydrophone of each buoy was approximately 50 m from the bottom in water depths of 645 m to 1034 m. During LADC 02 Tropical Storm Isidore and Hurricane Lili passed within approximately 73 nmi and 116 nmi, respectively, west of the EARS buoys. The proximity of these storm systems to the EARS buoys, in conjunction with wind speed data from three nearby National Data Buoy Center weather (NDBC) buoys, allows for the direct comparison of underwater ambient noise levels with high wind speeds. These results are compared to the G. M. Wenz spectra at frequencies from 1 kHz to 5.5 kHz. Anomalously high levels of ambient noise may be due to banding effects of the storms. Results of the ambient noise analysis will be presented.
DTIC
Ambience; Gulf of Mexico; Hydrophones; Noise (Sound); Underwater Acoustics; Wind Direction; Wind Velocity

20100018739 Naval Research Lab., Washington, DC USA
Environmental Mission Impact Assessment
Ballas, J; Cook, J; Jones, D; Jan 2008; 5 pp.; In English
Report No.(s): AD-A518011; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518011

The Environmental Visualization (EVIS) system for producing environmental mission impact assessment products was accepted as a transition in 2007 by the Fleet Numerical Meteorology and Oceanography Center (FNMOC) in Monterey, CA,

after passing operational testing and accreditation. EVIS is a service-oriented architecture (SOA) system developed by NRL and the Applied Physics Laboratory, University of Washington, to address human factors and automation issues associated with the stress of the operational tempo. Through a series of experiments, workflow and visualization shortfalls were identified in the battlespace environmental forecasting process. Experimental analysis resulted in the development of new applications, workflows, and visualization products that together constitute the EVIS system. Formal testing demonstrated a 40% reduction in the completion time for tactical air strike forecasts.
DTIC
Damage Assessment; Environmental Surveys; Impact

20100018942 Naval Research Lab., Monterey, CA USA
An Advanced Framework for Battlespace Environment Data Assimilation
Xu, L; Rosmond, T; Baker, N; Goerss, J; Jan 2007; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Battlespace environment data assimilation is a key element of the DoD's strategic plan to ensure information superiority and battlespace dominance in the 21st century. It is used to provide all the necessary initial conditions for making atmospheric/oceanic forecasts and to produce the common operational picture required by the warfighter. The Navy's current operational data assimilation systems are three-dimensional (3D) and provide the warfighter with a snapshot of the battlespace environment at a single point in time, several times a day. To provide the warfighter with a continuous picture of the battlespace environment over the time window of the observations used to generate the initial conditions, a highly advanced and efficient four-dimensional (4D) data assimilation algorithm suitable for both atmospheric and oceanic applications is essential. To meet the warfighter's requirement in the 21st century, scientists at NRL-Monterey have recently developed an advanced framework for battlespace environment data assimilation, called NAVDAS-AR: NRL Atmospheric Variational Data Assimilation System - Accelerated Representer. Here we give a brief description of the current operational system, then describe the NAVDAS-AR framework and its current and future applications.
DTIC
Assimilation; Data Processing; Meteorological Parameters; Oceanographic Parameters; Situational Awareness

20100018970 Naval Postgraduate School, Monterey, CA USA
Atmospheric Effects on Radio Frequency (RF) Wave Propagation in a Humid, Near-Surface Environment
Mason, Samuel P; Mar 2010; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Currently, the meteorological and physical phenomena associated with the various dynamic processes in the very near surface environment (for example, within the surface layer), are poorly understood. By properly characterizing what is happening in the real world, there is potential for obtaining an empirical formula that correlates well with real world data, and thus can be used as a means of quantifying these physical processes. This, in turn, can be used to more accurately model the effects of the atmosphere on RF waves. This thesis is an analysis of the propagation loss measurements taken from the Near Earth Propagation-6 (NEP-6), Panama City, FL, experiment in Aug 2009, where propagation loss was measured at 1768 MHz within a few wavelengths (approx. 0.5 meters) of the surface. The results support and extend the near-surface, short range RF propagation conclusions drawn by Merrill et al. (2004). In particular, we focus on a novel technique that takes advantage of tidal sea level variation to continuously vary antenna height above the surface. Results confirm a strong dependence of propagation loss on antenna height similar to Merrill et al.'s (2004) observations.
DTIC
Atmospheric Effects; Electromagnetic Scattering; Electromagnetic Wave Transmission; Humidity; Meteorological Parameters; Radio Frequencies; Wave Propagation

20100018971 Naval Postgraduate School, Monterey, CA USA
Optimization and Statistical Evaluation of GOES Cloud-Top Properties for Nowcasting Lightning Initiation
Harris, Ryan J; Mar 2010; 124 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A cumulus cloud field may develop within a conditionally unstable environment, but only a fraction of the cumulus elements eventually develop into thunderstorms. Determining which of these convective elements is most likely to generate lightning-a critical need for the aviation community and Department of Defense-often starts with little more than a qualitative visual satellite analysis. To protect personnel and property, lightning nowcast tools (e.g., an automated geostationary

satellite-based Lightning Initiation (LI) algorithm) require measurable research. This work quantifies the behavior of ten previously identified Geostationary Operational Environmental Satellite (GOES-12) Infrared (IR) Interest Fields (IFs) in the hour before LI. A total of 172 lightning-producing storms that occurred during the 2009 convective season are manually tracked and studied over four regions-Northern Alabama, Oklahoma, Kennedy Space Center and Washington D.C. Four-dimensional and cloud-to-ground lightning arrays provide precise lightning initiation points for each storm in both time and space. Individual tendencies are identified for the ten LI IFs. Statistical significance tests are conducted to determine the potential predictive capability and regional dependence of each IF. This study found that eight out of ten LI IFs exhibited at least 15 minutes of potential predictive capability and 35 minutes on average. Additionally, eight out of ten fields can likely be applied across a large geographical area with minimal error. Future operational applications identified and briefly explored in this work include the use of a lightning probability optimization tool.
DTIC
Cloud Physics; Lightning; Nowcasting; Statistical Analysis

20100018979 Naval Postgraduate School, Monterey, CA USA
Roughness Length Variability over Heterogeneous Surfaces
Ellis, Matthew A; Mar 2010; 96 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518617; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Monin-Obukhov similarity theory and the empirical formulae of Businger et al. (1971) and Dyer (1974) are used to calculate roughness lengths and surface-layer heat fluxes from multilevel observations of wind, temperature, and humidity measured at three locations in the Weather Information Network Display System at Cape Canaveral Air Force Station, Florida. Relationships between roughness length and surface-layer wind speed and direction in varying thermal stability conditions are analyzed during two four-day periods: a diurnally-cycling coastal wind circulation regime on 1-4 June 2008 and the passage of Tropical Storm Fay on 18-21 August 2008. Spatial and temporal variations in roughness lengths for a period of one year are compared to landscape features near the three observation platforms using shadow analysis of satellite photographs. Wind speeds during the coastal wind event remained below 10 ms(-1), and roughness lengths calculated from observations below 60 m corresponded to surface roughness elements within about 300 m. At the same height in the tropical storm case, for wind speeds exceeding 20 ms(-1), evidence is presented that indicates roughness lengths are related to surface features up to 1.5 km upstream.
DTIC
Heat Flux; Heterogeneity; Surface Roughness; Variability; Weather

20100018999 Naval Postgraduate School, Monterey, CA USA
The Relationship Between Total Cloud Lightning Behavior and Radar Derived Thunderstorm Structure
Metzger, Eric L; Mar 2010; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518656; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Total cloud lightning detection systems have been in development since the mid-1980s and have been deployed in several areas around the world. Previous studies on total cloud lightning have found intra and inter-cloud lightning (IC) tend to fluctuate significantly during the lifetime of thunderstorms. Prior studies have primarily focused on the electrical characteristics of thunderstorms, thunderstorm development and life cycle theory, but they do not provide much help to the operational meteorological community as they fail to link lightning characteristics to currently used radar interrogation techniques. Studies have indicated lightning jumps tend to be closely linked to changes in the vertical integrated liquid (VIL) reading on the National Weather Service's Weather Surveillance Radar-1998 Doppler (WSR-88D) systems and lightning holes tend to be associated with a bounded weak echo region (BWER) on the WSR-88D. More recent studies have attempted to mathematically classify a lightning jump but are still years away. This study builds off previous results and takes a more aggressive look at total cloud lightning and its relationship to the WSR-88D derived signatures currently used to determine a thunderstorms severity. Lightning and thunderstorm data from the Dallas-Fort Worth, Texas and the Tucson, Arizona areas from 2006-2009, was used to relate lightning to other thunderstorm parameters. A relationship between total cloud lightning behavior and currently used radar interrogation techniques was found indicating lightning jumps can be classified into three different types. Two types show preponderance for a specific type of severe weather event and lightning behavior while the third show no preference. These findings are of significant interest to the operational meteorological community and in some case can be put to immediate use.
DTIC
Cloud Physics; Detection; Lightning; Meteorological Radar; Thunderstorms

20100019009 Naval Research Lab., Bay Saint Louis, MS USA

Littoral Environmental Sensing Architecture (LESA) Report - The Current State of Sensing Capability for Naval Special Warfare METOC Support

Allard, Richard A; Dawson, Gretchen; Fox, Charles; Carroll, Suzanne N; Mar 10, 2010; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518676; NLR/MR/7320-10-9214; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study describes the Naval Special Warfare littoral sensing gaps and requirements, both in-situ and remotely sensed, and the environmental impacts affecting the warfighter. Topics include a review of warfighter requirements, concept of operations, available commercial off-the-shelf sensors, communications and capability development.

DTIC

Computer Programs; Detection; Detectors; Navy; Warfare

20100019012 Naval Postgraduate School, Monterey, CA USA

Toward Quantifying the Impact of Atmospheric Forcing on Arctic Sea Ice Variability Using the NPS 1/12 Degree Pan-Arctic Coupled Ice-Ocean Model

Tseng, Hsien-Liang R; Mar 2010; 196 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518687; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rapid Arctic sea ice decline since the 1970s has propelled the USA into a state of urgency for updating its defense plan as Arctic and non-Arctic nations alike are taking an interest in the newfound natural resources of an ice-declining Arctic. In line with the National Security Presidential Directive-66, we quantify the amount of anomalous sea ice variability (aSIV) that anomalous atmospheric forcing parameters explain using partial covariance analysis. A one-system approach where the NPS Model sea ice parameters are the direct output of the atmospheric forcing parameters input is employed. Atmospheric forcing fields of 2-m temperature, downward shortwave and longwave fluxes, 10-m zonal and meridional winds and stresses, are from the European Centre for Medium-Range Weather Forecasts Reanalysis-15 and Operational Products. Locations of interest are the Central Arctic seas, and locations along the Northwest Passage (NWP) and the Northern Sea Route (NSR). Results show that the atmospheric parameter having the largest influence on aSIV is anomalous surface air temperature. This occurs during the cooling months and averages 4-39% of aSAT contribution to aSIV in the Central Arctic, 9-16% along the NWP, and 11-25% along the NSR. Results also suggest that atmospheric forcing alone does not explain all of aSIV.

DTIC

Arctic Ocean; Arctic Regions; Ocean Models; Sea Ice; Variability

20100019036 National Defense Univ., Washington, DC USA

The Science and Art of Disaster Response by the National Guard

Rodriguez, Charles G; Jan 2008; 6 pp.; In English

Report No.(s): AD-A518783; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Response to a domestic emergency to save life, limb, and property of citizens is one of the fundamental roles of government at all levels, but especially at state and local levels. The domestic mission, including the continual development and refinement of doctrine to protect the homeland and its citizens, justifies at least as much emphasis as overseas military operations. This article suggests basic tenets for the military's contribution, particularly that of the National Guard, to an emergency response; highlights the importance of collaborative and unified efforts by all involved, both civilian and military; and summarizes evolving organizational concepts that might enhance such civilian-military collaboration.

DTIC

Armed Forces (United States); Disasters; Emergencies; Planning

20100019044 NMI Van Swinden Lab., Delft, Netherlands

Automated Delay Measurement System for an Earth Station for Two-Way Satellite Time and Frequency Transfer

Jong, Gerrit de; Polderman, Michel C; Dec 1994; 29 pp.; In English

Report No.(s): AD-A518812; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The measurement of the difference of the transmit and receive delays of the signals in a Two- Way Satellite Time and Frequency Transfer (TWSTFT) earth station is crucial for its nanosecond time transfer capability. Also, the monitoring of the change of this delay difference with time, temperature, humidity, or barometric pressure is important for improving the TWSTFT capabilities. An automated system for this purpose has been developed from the initial design at NMi-VSL. It calibrates separately the transmit and receive delays in cables, amplifiers, upconverters, and downconverters, and antenna

feeds. The obtained results can be applied as corrections to the TWSTFT measurement, when, before and after a measurement session, a calibration session is performed. Preliminary results obtained at NMi-VSL will be shown. Also, if available, the results of a manual version of the system that is planned to be circulated in September 1994 together with a USNO portable station on a calibration trip to European TWSTFT earth stations.
DTIC
Atmospheric Pressure; Clocks; Down-Converters; Frequencies; Time Measurement; Time Signals

20100019157 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Estimate of the North Atlantic Basin Tropical Cyclone Activity for the 2010 Hurricane Season
Wilson, Robert M.; May 2010; 48 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TP-2010-216429; M-1278; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019157

Estimates are presented for the tropical cyclone activity expected for the 2010 North Atlantic basin hurricane season. It is anticipated that the 2010 season will be more active than the 2009 season, reflecting increased frequencies more akin to that of the current more active phase that has been in vogue since 1995. Averages (+/- 1 sd) during the current more active phase are 14.5+/-4.7, 7.8+/-3.2, 3.7+/-1.8, and 2+/- 2, respectively, for the number of tropical cyclones (NTC), the number of hurricanes (NH), the number of major hurricanes (NMH), and the number of USA (U.S.) land-falling hurricanes (NUSLFH). Based on the 'usual' behavior of the 10-yma parametric first differences, one expects NTC = 19+/-2, NH = 14+/-2, NMH = 7+/-2, and NUSLFH = 4+/-2 for the 2010 hurricane season; however, based on the 'best guess' 10-yma values of surface-air temperature at the Armagh Observatory (Northern Ireland) and the Oceanic Nino Index, one expects NTC > or equals 16, NH > or equals 14, NMH > or equals 7, and NUSLFH > or equals 6.
Author
Hurricanes; Surface Temperature; Tropical Storms; Cyclones; Atmospheric Temperature

20100019190 Naval Research Lab., Bay Saint Louis, MS USA
Validation Test Report for the Global Ocean Forecast System V3.0 - 1/12 deg HYCOM-NCODA: Phase II
Metzger, E J; Hurlburt, H E; Wallcraft, A J; Shriver, J F; Townsend, T L; Smedstad, O M; Thoppil, P G; Franklin, D S; Peggion, G; Feb. 23, 2010; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518693; NRL/MR/7320--10-9236; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Global Ocean Forecast System Version 3.0 (V3.0) is comprised of the 1/12 deg global HYbrid Coordinate Ocean Model (HYCOM) and the Navy Coupled Ocean Data Assimilation (NCODA) system. It is a next-generation system capable of nowcasting and forecasting the oceanic weather, which includes the three-dimensional ocean temperature, salinity and current structure, the surface mixed layer and the location of mesoscale features such as eddies, meandering currents and fronts. V3.0 is scheduled to replace the existing nowcast/forecast system (V2.6) based on the 1/8 deg Navy Coastal Ocean Model (NCOM), 1/32 deg Navy Layered Ocean Model (NLOM), 1/8 deg Modular Ocean Data Analysis System (MODAS) and NCODA. This Phase II report describes the validation testing performed on one-year hindcasts of V3.0 and V2.6. A few Phase I tasks (temperature vs. depth and acoustical proxy error analyses) have been re-evaluated along with new evaluations examining a) each system as a provider of boundary conditions to a regional nested model, b) 14-day forecast skill relative to climatology and persistence of temperature vs. depth, c) 14-day forecast skill of acoustical proxies, d) 14-day forecast skill of sea surface height and sea surface temperature, and e) a velocity comparison against glider and drifting buoy observations. Overall, this report has determined that GOFS V3.0 is performing equal to or notably better than GOFS V2.6. The superior performance of V3.0 is especially evident in providing boundary contitions to regional nested models, an important function of a global ocean nowcast/forecast system.
DTIC
Forecasting; Oceanographic Parameters; Oceans

20100019272 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Phytoplankton and Climate
Moisan, John R.; November 02, 2009; 1 pp.; In English; Workshop and Conference on Biogeochemical Impacts of Climate and Land-Use Changes on Marine Ecosystems, 2-11 Nov. 2009, Trieste, Italy; No Copyright; Avail.: Other Sources; Abstract Only

Ocean phytoplankton supply about half of the oxygen that humans utilize to sustain life. In this lecture, we will explore

how phytoplankton plays a critical role in modulating the Earth's climate. These tiny organisms are the base of the Ocean's food web. They can modulate the rate at which solar heat is absorbed by the ocean, either through direct absorption or through production of highly scattering cellular coverings. They take up and help sequester carbon dioxide, a key greenhouse gas that modulated the Earth's climate. They are the source of cloud nucleation gases that are key to cloud formation/processes. They are also able to modify the nutrient budgets of the ocean through active uptake of inert atmospheric nitrogen. Climate variations have a pronounced impact on phytoplankton dynamics. Long term variations in the climate have been studied through geological interpretations on its influence on phytoplankton populations. The presentation will focus on presenting the numerous linkages that have been observed between climate and phytoplankton and further discuss how present climate change scenarios are likely to impact phytoplankton populations as well as present findings from several studies that have tried to understand how the climate might react to the feedbacks from these numerous climate-phytoplankton linkages.
Author
Climate Change; Phytoplankton; Greenhouse Effect; Modulation; Carbon Dioxide

20100019274 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Preliminary Investigation of Cyclic Behavior at SHADOZ Sites Between the Equator and 5 deg S Latitude
Schmidlin, F. J.; December 14, 2009; 1 pp.; In English; FROM 2009 Fall AGU Meeting, 14-18 Dec. 2009, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Investigation of cyclic behavior of temperature and ozone data from five SHADOZ sites between the Equator and 5degS Latitude (Nairobi, Ascension Island, Natal, San Crystobal, and Watukoset) reveal an amazing array of oscillations. In particular, eight years of measurements (1998-2007) reveal changes such as decreasing amounts of ozone at some pressure levels and/or sites, while other levels and/or sites experience increasing ozone. Temperature changes of 1-2 C occur that also experience irregular oscillations. This study is preliminary and only concentrates on the 250-, 200-, 100-, 70-, and 50-hPa pressure surfaces. Surfaces existing below and above the tropopause behave differently.
Author
Atmospheric Temperature; Atmospheric Composition; Ozone; Equators; Oscillations

20100019275 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Look at Seasonal Snow Cover and Snow Mass in the Southern Hemisphere from 1979-2006 Using SMMR and SSM/I Passive Microwave Data
Foster, James; December 13, 2009; 1 pp.; In English; American Geophysical Union Meetng, 13-16 Dec. 2009, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Seasonal snow cover in extra-tropical areas of South America was examined in this study using passive microwave satellite data from the Scanning Multichannel Microwave Radiometer (SMMR) on board the Nimbus-7 satellite and from the Special Sensor Microwave Imagers (SSM/I) on board the Defense Meteorological Satellite Program (DMSP) satellites. For the period from 1979-2006, both snow cover extent and snow mass were estimated for the months of May-September. Most of the seasonal snow in South America occurs in the Patagonia region of Argentina. The average snow cover extent for July, the month with the greatest average extent during the 28-year period of record, is 321,674 sq km. The seasonal (May-September) 2 average snow cover extent was greatest in 1984 (464,250 sq km) and least in 1990 (69,875 sq km). In terms of snow mass, 1984 was also the biggest year (1.19 x 10(exp 13) kg) and 1990 was the smallest year (0.12 X 10(exp 13) kg). A strong relationship exists between the snow cover area and snow mass, correlated at 0.95, though no significant trend was found over the 28 year record for either snow cover extent or snow mass. For this long term climatology, snow mass and snow cover extent are shown to vary considerably from month to month and season to season. This analysis presents a consistent approach to mapping and measuring snow in South America utilizing an appropriate and readily available long term snow satellite dataset. This is the optimal dataset available, thus far, for deriving seasonal snow cover and snow mass in this region. Nonetheless, shallow snow, wet snow, snow beneath forests, as well as snow along coastal areas all may confound interpretation using passive microwave approaches. More work needs to be done to reduce the uncertainties in the data and hence, increase the confidence of the interpretation
Author
Snow Cover; Microwave Radiometers; Climatology; South America; Remote Sensing; Nimbus 7 Satellite; Microwave Imagery

20100019283 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Simulation and 'TWINS Observations of the 22 July 2009 Storm
Fok, Mei-Ching; Buzulukova, Natalia Y.; Chen, Sheng-Hsien; Valek, Phil; Goldstein, Jerry; McComas, David; [2010]; 1 pp.;

In English; 2010 Wstern Pacific Geophysics Meeting, 22-25 Jun. 2010, Taipei, Taiwan, Province of China; Copyright; Avail.: Other Sources; Abstract Only

TWINS is the first mission to perform stereo imaging of the Earth's ring current. The magnetic storm on 22 July 2009 is the largest storm observed since TWINS began routine stereo imaging in June 2008. On 22 July 2009, the Dst dropped to nearly -80nT at 7:00 and 10:00 UT. During the main phase and at the peak of the storm, TWINS 1 and 2 were near apogee and moving from pre-dawn to post-dawn local time. The energetic neutral atom (ENA) imagers on the 2 spacecraft captured the storm intensification and the formation of the partial ring current. The peak of the ENA emissions was seen in the midnight-to-dawn local-time sector. The development of this storm has been simulated using the Comprehensive Ring Current Model (CRCM) to understand and interpret the observed signatures. We perform CRCM runs with constant and time-varying magnetic field. The model calculations are validated by comparing the simulated ENA and ion flux intensities with TWINS ENA images and in-situ ion data from THEMIS satellites. Simulation with static magnetic field produces a strong shielding electric field that skews the ion drift trajectories toward dawn. The model's corresponding peak ENA emissions are always eastward than those in the observed TWINS images. On the other hand, simulation with a dynamic magnetic field gives better spatial agreements with both ENA and insitu particle data, suggesting that temporal variations of the geomagnetic field exert a significant influence upon global ring current ion dynamics.

Author

Imaging Techniques; Ring Currents; Geomagnetism; In Situ Measurement; Magnetostatic Fields; Magnetic Variations; Magnetic Storms

20100019289 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Limits on O VI Emission from the Shocked Circumstellar Gas of SN 1987A

Sonneborn, George; Iping, Rosina C.; Fransson, Claes; October 20, 2008; 3 pp.; In English; Future Direction in UItraviolet Spectroscopy, 20-22 Oct. 2008, Annapolis, MD, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019289

The Far Ultraviolet Spectroscopic Explorer (FUSE) was used to search for emission from the shock interaction of the ejecta of SN 1987A with its circumstellar material. FUSE observations of SN 1987A between 2000 and 2007 did not detect broad OVI emission. However, OVI emission was detected in 2000-2001 with a narrow line width (FWHM <35 kms t) and a heliocentric radial velocity of +280 km/s. This places the emitting gas at rest relative to the supernova and is interpreted as emission from unshocked circumstellar gas. This narrow emission had disappeared in 2007 (and possibly earlier) as a result of the advancing shock overtaking the H II region that was flash ionized by the supernova explosion in 1987.

Author

Far UV Spectroscopic Explorer; Shock Wave Interaction; Stellar Envelopes; H II Regions; Supernovae

20100019340 Noblis, Inc., Falls Church, VA USA; Geological Survey, Baltimore, MD, USA; Maryland Univ., Solomons, MD, USA; WeatherFlow, Inc., Poquoson, VA, USA

Chesapeake Inundation Prediction System (CIPS): A Regional Prototype for a National Problem

Stamey, Barry; Smith, Wade; Carey, Kenneth; Garbin, David; Klein, Fred; Wang, Harry; Shen, Jian; Gong, Wenping; Cho, Joe; Forrest, David; Friedrichs, Carl; Boicourt, William; Li, Ming; Koterba, Michael; King, Dennis; Titlow, Jay; Smith, Elizabeth; Siebers, Anthony; Billet, John; Lee, James; Jan. 2007; 11 pp.; In English; MTS/IEEE Oceans 2007 Conference held in Vancouver, BC, Canada on 29 Sep-4 Oct 2007, 29 Sep. - 4 Oct. 2007, Vancoulver, BC, Canada; Original contains color illustrations

Report No.(s): AD-A518173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518173

Recent Hurricanes Katrina and Isabel, among others, not only demonstrated their immense destructive power, but also revealed the obvious, crucial need for improved storm surge forecasting and information delivery to save lives and property in future storms. Current operational methods and the storm surge and inundation products do not adequately meet requirements needed by Emergency Managers (EMs) at local, state, and federal levels to protect and inform our citizens. The Chesapeake Bay Inundation Prediction System (CIPS) is being developed to improve the accuracy, reliability, and capability of flooding forecasts for tropical cyclones and non-tropical wind systems such as nor'easters by modeling and visualizing expected on-land storm-surge inundation along the Chesapeake Bay and its tributaries. An initial prototype has been developed by a team of government, academic and industry partners through the Chesapeake Bay Observing System (CBOS) of the Mid-Atlantic Coastal Ocean Observing Regional Association (MACOORA) within the Integrated Ocean Observing System (IOOS). For demonstration purposes, this initial prototype was developed for the tidal Potomac River in the Washington, DC

metropolitan area. The preliminary information from this prototype shows great potential as a mechanism by which NOAA National Weather Service (NWS) Forecast Offices (WFOs) can provide more specific and timely forecasts of likely inundation in individual localities from significant storm surge events. This prototype system has shown the potential to indicate flooding at the street level, at time intervals of an hour or less, and with vertical resolution of one foot or less. This information will significantly improve the ability of EMs and first responders to mitigate life and property loss and improve evacuation capabilities in individual communities. This paper provides an update and expansion of the initial prototype that was presented at the Oceans 2006 MTS/IEEE Conference in Boston, MA.
DTIC
Chesapeake Bay (US); Emergencies; Forecasting; Prediction Analysis Techniques; Prototypes

20100019377 National Oceanic and Atmospheric Administration, Washington, DC, USA
Tropical Ocean and Global Atmosphere Programme
January 1983; 36 pp.; In English
Report No.(s): PB2010-104365; No Copyright; Avail.: CASI: A03, Hardcopy

The Tropical Ocean Global Atmosphere program is a major component of the World Climate Research Program (WCRP) aimed specifically at the prediction of climate phenomena on time scales of months to years. The philosophy upon which TOGA is based purposefully emphasizes the tropical oceans and their relationship to the global atmosphere. Underlying TOGA is the premise that the dynamic adjustment of the ocean in the tropics is far more rapid than at higher latitudes. Thus disturbances emanating from the western Pacific Ocean (such as El Nino) may propagate across the basin on time scales of weeks compared to years for corresponding basin-wide propagation at higher latitudes. The significance of shorter dynamic times scales near the equator is that they are similar to those of highly energetic atmospheric modes. This similarity allows the formation of coupled modes between the ocean and the atmosphere.
NTIS
Air Water Interactions; Atmospheric Circulation; Oceanographic Parameters; Oceans; Tropical Regions

20100019403 Department of Energy, Washington, DC, USA
A Year of Radiation Measurements at the North Slope of Alaska
McFarlane, S. A.; Shi, Y.; Long, C. N.; April 2009; 7 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2010-952496; DOE/SC-ARM/P-09-010; No Copyright; Avail.: Department of Energy Information Bridge

In 2009, the Atmospheric Radiation Measurement (ARM) Program and the Climate Change Prediction Program (CCPP) have been asked to produce joint science metrics. For CCPP, the second quarter metrics are reported in Evaluation of Simulated Precipitation in CCSM3: Annual Cycle Performance Metrics at Watershed Scales. For ARM, the metrics will produce and make available new continuous time series of radiative fluxes based on one year of observations from Barrow, Alaska, during the International Polar Year and report on comparisons of observations with baseline simulations of the Community Climate System Model (CCSM). Observations from a suite of radiometers including Precision Spectral Pyranometers (PSPs), Precision Infrared Radiometers (PIRs), and a Normal Incident Pyrheliometer (NIP) are combined with surface meteorological instruments using the Quality Control of Radiation (QCRad) Value Added Product (VAP; Long and Shi 2006; Long and Shi 2008) to assess data quality and produce a continuous time series of broadband radiative flux measurements for 2008 at Barrow (C1) and Atqasuk (C2), Alaska. The QCRad methodology uses climatological analyses of the surface radiation measurements to define reasonable limits for testing the data for unusual data values and produces best estimates of observed radiative fluxes. The methodology not only sets standard maximum and minimum value limits, but includes many cross-comparisons based on what the ARM Program has learned about how these instruments behave in the field. In addition, the unshaded pyranometer measurements are corrected for thermal offsets using historical correction coefficients at the North Slope of Alaska (NSA) site.
NTIS
Atmospheric Radiation; Climate; Radiation Measurement; Alaska

20100019404 Department of Energy, Washington, DC, USA
ACRF Instrumentation Status: New, Current, and Future. (February 2009)
Voyles, J.; February 2009; 21 pp.; In English
Contract(s)/Grant(s): DE-AC05-01830
Report No.(s): DE2010-952494; DOE/SC-ARM/P-09-004.2; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of this report is to provide a concise but comprehensive overview of Atmospheric Radiation Measurement Climate Research Facility instrumentation status. The report is divided into the following five sections: (1) new instrumentation in the process of being acquired and deployed, (2) field campaigns, (3) existing instrumentation and progress on improvements or upgrades, (4) proposed future instrumentation, and (5) Small Business Innovation Research instrument development.
NTIS
Atmospheric Radiation; Climate; Radiation Measurement; Research Facilities

20100019413 Federal Bureau of Measures and Precious Metals, Belgrade, Macedonia
Meteorological Influences on Loran-C Propagation Over Sea and Land in Mediterranean Sea Chain
Markovic, Zoran M; Dec 1988; 13 pp.; In English
Report No.(s): AD-A518818; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Loran-C phase variations of signal from the Master of the Mediterranean Sea chain at Sellia Marina were measured simultaneously at three receiving sites, located on sea, coast and land. The effect of terrain over which the signal is propagated is considered together with the influence of weather parameters on the phase variations at the transmitter, along the signal paths and at the receiving sites. Based on an analysis of these data, correlations among these variations are examined, and correction is introduced to the measured results, in order to improve precision of mutual and international comparisons via Loran-C.
DTIC
LORAN; LORAN C; Mediterranean Sea; Seas

20100019457 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hydrologic Applications of GRACE Terrestrial Water Storage Data
Rodell, Matthew; Zaitchik, Benjamin F.; Li, Bailing; Bolten, John; Hourborg, Rasmus; Velicogna, Isabella; Famiglietti, Jay; December 14, 2009; 1 pp.; In English; 2009 American Geophysical Union Conference, 14-18 Dec. 2009, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Gravimetry-based terrestrial water storage time series have great potential value for hydrological research and applications, because no other observing system can provide global maps of the integrated quantity of water stored on and below the land surface. However, these data are challenging to use because their spatial and temporal resolutions are low relative to other hydrological observations and because total terrestrial water storage is a measurement unfamiliar to hydrologists. In this presentation we will review techniques for temporal, horizontal, and vertical disaggregation of GRACE terrestrial water storage anomalies, including data assimilation and integration within a land surface model. We will then discuss initial results from three efforts to use the methods for water resources applications. These include drought monitoring across North America, water cycle assessment over the Middle East North African region, and groundwater depletion estimates for northern India.
Author
Hydrology; Grace Mission; Water Resources; Gravimetry; Extraterrestrial Water

20100019474 Texas Water Development Board, Austin, TX, USA
Climate and Physiography of the Texas Coastal Zone
Kane, John W.; October 1970; 23 pp.; In English
Report No.(s): PB2010-108497; No Copyright; Avail.: CASI: A03, Hardcopy

Physiographers have classified the entire Coastal Zone of Texas as part of the West Gulf Coast Section of the Coastal Plain Province. The immediate Coastal Zone is almost uniformly flat and low with a gradual increase both in height and abruptly at the Balcones Escarpment which generally follows a Del Rio-San Antonio-Austin line. North of Austin, the transition is less abrupt, but follows approximately a line from Austin through Dallas to the Oachita Mountains in Oklahoma.
NTIS
Atmospheric Temperature; Climate; Coasts; Geomorphology; Precipitation (Meteorology)

20100019490 Nature Conservancy, Arlington, VA, USA

Carbon Accounting, Trading and the Temporary Nature of Carbon Storage

Costa, Pedro Moura; January 2002; 26 pp.; In English

Contract(s)/Grant(s): LAG-A-00-00-00019-00

Report No.(s): PB2010-107622; Copyright; Avail.: National Technical Information Service (NTIS)

One of the main concerns related to the use of sinks as a greenhouse gas (GHG) mitigation option is the question of permanence, the length of time for which carbon will remain stored after having been fixed in vegetation, or the reversibility of the benefits of storage. This paper analyses the various approaches proposed for dealing with the temporal nature of sequestration, and the financial implications of using them.

NTIS

Carbon; Greenhouse Effect

20100019516 Colorado State Univ., Fort Collins, CO, USA

Refinement, Validation and Application of Cloud-Radiation Parameterization in a GCM

Stephensd, G. L.; Apr. 30, 2009; 84 pp.; In English

Contract(s)/Grant(s): FG02-94ER61748

Report No.(s): DE2010-951779; DOE/FG-61748-3; No Copyright; Avail.: National Technical Information Service (NTIS)

The research performed under this award was conducted along 3 related fronts: (1) Refinement and assessment of parameterizations of sub-grid scale radiative transport in GCMs. (2) Diagnostic studies that use ARM observations of clouds and convection in an effort to understand the effects of moist convection on its environment, including how convection influences clouds and radiation. This aspect focuses on developing and testing methodologies designed to use ARM data more effectively for use in atmospheric models, both at the cloud resolving model scale and the global climate model scale. (3) Use (1) and (2) in combination with both models and observations of varying complexity to study key radiation feedback Our work toward these objectives thus involved three corresponding efforts. First, novel diagnostic techniques were developed and applied to ARM observations to understand and characterize the effects of moist convection on the dynamical and thermodynamical environment in which it occurs. Second, an in house GCM radiative transfer algorithm (BUGSrad) was employed along with an optimal estimation cloud retrieval algorithm to evaluate the ability to reproduce cloudy-sky radiative flux observations. Assessments using a range of GCMs with various moist convective parameterizations to evaluate the fidelity with which the parameterizations reproduce key observable features of the environment were also started in the final year of this award. The third study area involved the study of cloud radiation feedbacks and we examined these in both cloud resolving and global climate models.

NTIS

Climate Models; Parameterization

20100019527 National Oceanic and Atmospheric Administration, Boulder, CO, USA; Colorado State Univ., Fort Collins, CO, USA

Cloud Scavenging Effects on Aerosol Radiative and Cloud-nucleating Properties

Ogren, J. A.; Sheridan, P. S.; Andrews, E.; Feb. 26, 2009; 21 pp.; In English

Contract(s)/Grant(s): AI02-08ER64576

Report No.(s): DE2010-948732; DOE/ER-64576-FIN; No Copyright; Avail.: National Technical Information Service (NTIS)

The optical properties of aerosol particles are the controlling factors in determining direct aerosol radiative forcing. These optical properties depend on the chemical composition and size distribution of the aerosol particles, which can change due to various processes during the particles lifetime in the atmosphere. Over the course of this project we have studied how cloud processing of atmospheric aerosol changes the aerosol optical properties. A counterflow virtual impactor was used to separate cloud drops from interstitial aerosol and parallel aerosol systems were used to measure the optical properties of the interstitial and cloud-scavenged aerosol. Specifically, aerosol light scattering, back-scattering and absorption were measured and used to derive radiatively significant parameters such as aerosol single scattering albedo and backscatter fraction for cloud-scavenged and interstitial aerosol. This data allows us to demonstrate that the radiative properties of cloud-processed aerosol can be quite different than pre-cloud aerosol. These differences can be used to improve the parameterization of aerosol forcing in climate models.

NTIS

Aerosols; Cloud Physics; Nucleation; Scavenging

20100019529 Scripps Institution of Oceanography, San Diego, CA, USA; Lawrence Livermore National Lab., Livermore, CA USA

Single-column Modeling, GCM Parameterizations, and ARM Data

Somerville, R. C. J.; Jan. 2007; 11 pp.; In English

Contract(s)/Grant(s): DE-FG02-97ER62338

Report No.(s): DE2010-948450; No Copyright; Avail.: National Technical Information Service (NTIS)

Our overall goal is the development of new and improved parameterizations of cloud-radiation effects and related processes, using ARM data at all three ARM sites, and the implementation and testing of these parameterizations in global models. To test recently developed prognostic parameterizations based on detailed cloud microphysics, we have compared SCM (single-column model) output with ARM observations at the SGP, NSA and TWP sites. We focus on the predicted cloud amounts and on a suite of radiative quantities strongly dependent on clouds, such as downwelling surface shortwave radiation. Our results demonstrate the superiority of parameterizations based on comprehensive treatments of cloud microphysics and cloud-radiative interactions. At the SGP and NSA sites, the SCM results simulate the ARM measurements well and are demonstrably more realistic than typical parameterizations found in conventional operational forecasting models. At the TWP site, the model performance depends strongly on details of the scheme, and the results of our diagnostic tests suggest ways to develop improved parameterizations better suited to simulating cloud-radiation interactions in the tropics generally. These advances have made it possible to take the next step and build on this progress, by incorporating our parameterization schemes in state-of-the-art three-dimensional atmospheric models, and diagnosing and evaluating the results using independent data. Because the improved cloud-radiation results have been obtained largely via implementing detailed and physically comprehensive cloud microphysics, we anticipate that improved predictions of hydrologic cycle components, and hence of precipitation, may also be achievable.

NTIS

Atmospheric Radiation; Climate Models; Climatology; Parameterization; Radiation Effects; Radiation Measurement

20100019544 Department of Energy, Washington, DC, USA

ACRF Instrumentation Status: New, Current, and Future. (January 2009)

Voyles, J.; Jan. 2009; 21 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2010-952490; DOE/SC-ARM/P-09-004.1; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of this report is to provide a concise but comprehensive overview of Atmospheric Radiation Measurement Climate Research Facility instrumentation status. The report is divided into the following five sections: (1) new instrumentation in the process of being acquired and deployed, (2) field campaigns, (3) existing instrumentation and progress on improvements or upgrades, (4) proposed future instrumentation, and (5) Small Business Innovation Research instrument development.

NTIS

Atmospheric Radiation; Climate; Radiation Measurement; Research Facilities

20100019651 Naval Research Lab., Bay Saint Louis, MS USA

Erosion during Hurricane Isabel

Rowley, C D; Keen, T R; Dykes, J D; Jan 2006; 4 pp.; In English

Report No.(s): AD-A518864; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518864

A better understanding of the complex interplay between ocean waves, water levels, and currents, and the movement of sediment in the dune-beach system will improve predictions of coastal environmental hazards, water-column optics, bar movement, and mine burial -- all of which have tactical implications. Historically, this interaction of different processes has been modeled by using simple parameterizations. In this study, we explicitly simulate the above processes through a suite of numerical models. We use a depiction of the landfall of Hurricane Isabel (2003) on the barrier islands of Cape Hatteras, North Carolina, to examine potential erosion that contributes to barrier island breaching and washover. This prototype for a rapidly relocatable nearshore sediment transport modeling system will take advantage of recent advances in Navy technology for global deep-ocean and coastal environmental modeling.

DTIC

Beaches; Coasts; Erosion; Hurricanes; Islands; Ocean Currents; Ocean Surface; Sediment Transport; Water Erosion; Water Waves

20100019696 Massachusetts Inst. of Tech., Lexington, MA USA

Signal Processing Algorithms for the Terminal Doppler Weather Radar: Build 2

Cho, J Y; Apr 30, 2010; 95 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0002

Report No.(s): AD-A518992; ATC-363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518992

As a new radar data acquisition system (RDA) was developed for the Terminal Doppler Weather Radar (TDWR), enhanced signal processing algorithms taking advantage of its increased capabilities were also developed. The primary goals of protecting the base data estimates from range-aliased signals and providing reliable velocity dealiasing were achieved through multiple pulse repetition interval (PRI) and phase coding methods. An innovative radial-by-radial adaptive selection process was used to take full advantage of the different techniques, the first time such an approach has been implemented for weather radars. Improvement in clutter filtering was also achieved. This report discusses in detail these new RDA signal processing algorithms.

DTIC

Algorithms; Data Acquisition; Doppler Radar; Meteorological Radar; Signal Processing

20100019708 Naval Research Lab., Washington, DC USA

Characterization of Bulk GaN Crystals Grown From Solution at Near Atmospheric Pressure

Garces, N Y; Feigelson, B N; Freitas, Jr, J A; Kim, Jihyun; Myers-Ward, R L; Glaser, E R; Jan 2010; 7 pp.; In English

Report No.(s): AD-A519013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519013

The properties of GaN crystals grown from solution at temperatures ranging from 780 to 810 1C and near atmospheric pressure 0.14 MPa, have been investigated using low temperature X-band (9.5 GHz) electron paramagnetic resonance spectroscopy, micro-Raman spectroscopy, photoluminescense spectroscopy, and photoluminescence imaging. Our samples are spontaneously nucleated thin platelets of approximate dimensions of 220.025 mm3, or samples grown on both polycrystalline and single crystal HVPE large-area (380.5 mm3) seeds. Electron paramagnetic resonance spectra consists of a single Lorentzian line with axial symmetry about the c-axis, with approximate g-values, gJ 1.951 and g? 1.948 and a peak-to-peak linewidth of 4.0 G. This resonance has been previously assigned to shallow impurity donors/conduction electrons in GaN and attributed to Si- and/or O impurities. Room temperature photoluminescence and photoluminescence imaging data from both Ga and N-faces show different dominant emission bands, suggesting different incorporation of impurities and/or native defects. Raman scattering and X-ray diffraction show moderate to good crystalline quality.

DTIC

Atmospheric Pressure; Crystal Growth; Crystals; Gallium Nitrides; Photoluminescence; Semiconductors (Materials)

20100019718 California Univ., Los Angeles, CA USA

Aerosol Impacts on Cirrus Clouds and High-Power Laser Transmission: A Combined Satellite Observation and Modeling Approach

Liou, Kuo-Nan; Feb 28, 2010; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-09-1-0386

Report No.(s): AD-A519036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519036

The objective of this basic research effort is to provide the theoretical foundations for modeling/simulating the interaction of aerosols and ice at high altitudes (near and above the tropopause). The AF, together with the ABL SPO (through the MDA), anticipate that aerosols/ice will impact the efficacy of the ABL and the ability to predict possible impacts is of great value. The PI and his colleagues will interrogate a number of conceptual schemes which incorporate cloud microphysics (with 6 classes of moisture species together with actual ice concentrations). Particular attention will be paid to ice nucleation scenarios.

DTIC

Aerosols; Cirrus Clouds; High Power Lasers; Ice; Satellite Observation

20100019753 Naval Observatory, Flaggstaff, AZ USA

The Spatially Resolved H(alpha)-Emitting Wind Structure of P Cygni

Balan, Aurelian; Tycner, C; Zavala, R T; Benson, J A; Hutter, D J; Templeton, M; Jun 2010; 11 pp.; In English

Report No.(s): AD-A519136; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519136

High spatial resolution observations of the H(alpha)-emitting wind structure associated with the luminous blue variable star P Cygni were obtained with the Navy Prototype Optical Interferometer. These observations represent the most comprehensive interferometric data set on P Cyg to date. We demonstrate how the apparent size of the H(alpha)-emitting region of the wind structure of P Cyg compares between the 2005, 2007, and 2008 observing seasons and how this relates to the H(alpha) line spectroscopy. Using the data sets from 2005, 2007, and 2008 observing seasons, we fit a circularly symmetric Gaussian model to the interferometric signature from the H(alpha)-emitting wind structure of P Cyg. Based on our results, we conclude that the radial extent of the H(alpha)-emitting wind structure around P Cyg is stable at the 10% level. We also show how the radial distribution of the H(alpha) flux from the wind structure deviates from a Gaussian shape, whereas a two-component Gaussian model is sufficient to fully describe the H(alpha)-emitting region around P Cyg.

DTIC

Cygnus Constellation; Interferometry; Variable Stars

20100019792 Naval Research Lab., Washington, DC USA

Advancement of Infrasound Propagation Calculation Techniques Using Mesoscale Atmospheric and Terrain Specifications

Gibson, Robert G; Drob, Douglas P; Norris, David E; Sep 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W9113M-05-C-0132

Report No.(s): AD-A519266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519266

Numerical calculation of infrasound propagation paths is necessary to support accurate infrasound event identification, phase association, and source location. Predicting the details of infrasound propagation relies both on propagation models that capture the fundamental physical processes and on characterization of the propagation medium, namely the global atmosphere from the ground to altitudes above 100 km. Therefore the accuracy of propagation modeling depends in part on the fidelity of the atmospheric characterization. Furthermore, for infrasound propagation at regional and local ranges, characterized by higher frequencies than propagation at global ranges, effects of the boundary conditions of the propagation domain, in particular the terrain elevation, become increasingly important. The analysis tool kit Infrasound Modeling of Atmospheric Propagation (InfraMAP) integrates infrasound propagation models and environmental representations, including synoptic updates of the atmospheric specification at low and middle altitude, such as the output from numerical weather prediction models that supplement climatological characterization of temperature, wind, and air composition at high altitude. The Naval Research Laboratory (NRL) Ground-to-Space (G2S) semi-empirical spectral model provides a global specification of the atmosphere that can be utilized in InfraMAP. These capabilities for propagation calculation and atmospheric specification allow infrasound researchers to investigate critical propagation phenomena, conduct sensitivity studies, and compare results of numerical modeling with observed signals. Recent efforts develop techniques for utilizing accurate, high-resolution regional atmospheric specifications and terrain elevation databases with infrasound propagation modeling codes.

DTIC

Infrasonic Frequencies; Mesometeorology; Mesoscale Phenomena; Terrain

20100019946 Massachusetts Inst. of Tech., Cambridge, MA USA

Using the Maximum Entropy Principle as a Unifying Theory for Characterization and Sampling of Multi-scaling Processes in Hydrometeorology

Bras, Rafael L; Wang, Jingfeng; Feb 25, 2010; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-1-0126

Report No.(s): AD-A519510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this proposal is to explore the idea of Maximum Entropy (MaxEnt) as a unifying principle to characterize multi-scaling hydrometeorological parameters such as rainfall and soil moisture, and develop a MaxEnt-based design of data collection networks for the sampling of multiscaling processes. The approach we follow is to relate the scaling distributions of hydrologic variables of interest to the macroscopic properties of the system and then use those distributions in a monitoring

DTIC

Entropy; Hydrometeorology; Hydrometeors; Maximum Entropy Method; Sampling

20100020142 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Interannual Stability of Cumulative Frequency Distributions for Convective System Size and Intensity

Mohr, Karen I.; Molinari, John; Thorncroft, Chris D,; [2010]; 41 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNX07AD45G; NSF ATM0732255; NSF ATM0538164; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100020142

The characteristics of convective system populations in West Africa and the western Pacific tropical cyclone basin were analyzed to investigate whether interannual variability in convective activity in tropical continental and oceanic environments is driven by variations in the number of events during the wet season or by favoring large and/or intense convective systems. Convective systems were defined from TRMM data as a cluster of pixels with an 85 GHz polarization-corrected brightness temperature below 255 K and with an area at least 64 km 2. The study database consisted of convective systems in West Africa from May Sep for 1998-2007 and in the western Pacific from May Nov 1998-2007. Annual cumulative frequency distributions for system minimum brightness temperature and system area were constructed for both regions. For both regions, there were no statistically significant differences among the annual curves for system minimum brightness temperature. There were two groups of system area curves, split by the TRMM altitude boost in 2001. Within each set, there was no statistically significant interannual variability. Sub-setting the database revealed some sensitivity in distribution shape to the size of the sampling area, length of sample period, and climate zone. From a regional perspective, the stability of the cumulative frequency distributions implied that the probability that a convective system would attain a particular size or intensity does not change interannually. Variability in the number of convective events appeared to be more important in determining whether a year is wetter or drier than normal.

Author

Cyclones; Tropical Regions; Tropical Storms; Climate; Brightness Temperature; Frequency Distribution; TRMM Satellite; Convection

20100020144 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Changes in the TRMM Version-5 and Version-6 Precipitation Radar Products Due to Orbit Boost

Liao, Liang; Meneghini, Robert; [2010]; 38 pp.; In English; Submitted to Journal of Meteorological Society of Japan for Special issue on Satellite Precipitation Observation; Original contains black and white illustrations

Contract(s)/Grant(s): NNH06ZDA001N-PMM; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100020144

The performance of the version-5 and version-6 Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR) products before and after the satellite orbit boost is assessed through a series of comparisons with Weather Surveillance Radar (WSR)-88D ground-based radar in Melbourne, Florida. Analysis of the comparisons of radar reflectivity near the storm top from the ground radar and both versions of the PR indicates that the PR bias relative to the WSR radar at Melbourne is on the order of 1dB for both pre- and post-boost periods, indicating that the PR products maintain accurate calibration after the orbit boost. Comparisons with the WSR-88D near-surface reflectivity factors indicate that both versions of the PR products accurately correct for attenuation in stratiform rain. However, in convective rain, both versions exhibit negative biases in the near-surface radar reflectivity with version-6 products having larger negative biases than version-5. Rain rate comparisons between the ground and space radars show similar characteristics

Author

TRMM Satellite; Precipitation (Meteorology); Rain; Meteorological Radar; Storms (Meteorology); Surveillance Radar; Convection; Calibrating

20100020167 Jet Propulsion Lab., California Inst. of Tech., Wrightwood, CA, USA

Measurements of Humidity in the Atmosphere: Validation Experiments (MOHAVE I and MOHAVE II). Results Overview and Implication for the Long-Term Lidar Monitoring of Water Vapor in the UT/LS

Leblanc, Thierry; McDermid, I. S.; Vomel, H.; Whiteman, D.; Twigg, Larry; McGee, T. G.; February 11, 2008; 12 pp.; In English; First ISSI/NDACC Water Vapor Workshop, 11-14 Feb. 2008, Bern, Switzerland; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41532

1. MOHAVE+MOHAVE II = very successful. 2. MOHAVE -> Fluorescence was found to be inherent to all three participating lidars. 3. MOHAVE II -> Fluorescence was removed and agreement with CFH was extremely good up to 16-18 km altitude. 4. MOHAVE II -> Calibration tests revealed unsuspected shortfalls of widely used techniques, with important implications for their applicability to longterm measurements. 5. A factor of 5 in future lidar signal-to-noise ratio is reasonably

achievable. When this level is achieved water vapor Raman lidar will become a key instrument for the long-term monitoring of water vapor in the UT/LS
Author
Water Vapor; Humidity; Optical Radar; Fluorescence

20100020176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Multi-Scale Hydrometeorological Modeling, Land Data Assimilation and Parameter Estimation with the Land Information System
Peters-Lidard, Christa D.; Kumar, Sujay V.; Santanello, Joseph A., Jr.; Reichle, Rolf H.; August 24, 2009; 1 pp.; In English; 6th International Scientific Conference on Global Energy and Water Cycle/2nd Integrated Land Ecosystem-Atmosphere Processes Study Science Conference - Water in a Changing Climate: Progress in Land-Atmosphere Interactions and Energy/Water Cycle Research, 24-28 Aug. 2009, Melbourne, Australia; Copyright; Avail.: Other Sources; Abstract Only

The Land Information System (LIS; http://lis.gsfc.nasa.gov; Kumar et al., 2006; Peters- Lidard et al.,2007) is a flexible land surface modeling framework that has been developed with the goal of integrating satellite- and ground-based observational data products and advanced land surface modeling techniques to produce optimal fields of land surface states and fluxes. As such, LIS represents a step towards the next generation land component of an integrated Earth system model. In recognition of LIS object-oriented software design, use and impact in the land surface and hydrometeorological modeling community, the LIS software was selected ase co-winner of NASA's 2005 Software of the Year award. LIS facilitates the integration of observations from Earth-observing systems and predictions and forecasts from Earth System and Earth science models into the decision-making processes of partnering agency and national organizations. Due to its flexible software design, LIS can serve both as a Problem Solving Environment (PSE) for hydrologic research to enable accurate global water and energy cycle predictions, and as a Decision Support System (DSS) to generate useful information for application areas including disaster management, water resources management, agricultural management, numerical weather prediction, air quality and military mobility assessment. LIS has evolved from two earlier efforts North American Land Data Assimilation System (NLDAS; Mitchell et al. 2004) and Global Land Data Assimilation System (GLDAS; Rodell al. 2004) that focused primarily on improving numerical weather prediction skills by improving the characterization of the land surface conditions. Both of GLDAS and NLDAS now use specific configurations of the LIS software in their current implementations. In addition, LIS was recently transitioned into operations at the US Air Force Weather Agency (AFWA) to ultimately replace their Agricultural Meteorology (AGRMET) system, and is also used routinely by NOAA's National Centers for Environmental Prediction (NCEP)/Environmental Modeling Center (EMC) for their land data assimilation systems to support weather and climate modeling. LIS not only consolidates the capabilities of these two systems, but also enables a much larger variety of configurations with respect to horizontal spatial resolution, input datasets and choice of land surface model through 'plugins,'. As described in Kumar et al., 2007, and demonstrated in Case et al., 2008, and Santanello et al., 2009, LIS has been coupled to the Weather Research and Forecasting (WRF) model to support studies of land-atmosphere coupling the enabling ensembles of land surface states to be tested against multiple representations of the atmospheric boundary layer. LIS has also been demonstrated for parameter estimation as described in Peters-Lidard et al. (2008) and Santanello et al. (2007), who showed that the use of sequential remotely sensed soil moisture products can be used to derive soil hydraulic and texture properties given a sufficient dynamic range in the soil moisture retrievals and accurate precipitation inputs. LIS has also recently been demonstrated for multi-model data assimilation (Kumar et al., 2008) using an Ensemble Kalman Filter for sequential assimilation of soil moisture, snow, and temperature. Ongoing work has demonstrated the value of bias correction as part of the filter, and also that of joint calibration and assimilation. Examples and case studies demonstrating the capabilities and impacts of LIS for hydrometeoroogical modeling, assimilation and parameter estimation will be presented as advancements towards the next generation of integrated observation and modeling systems.
Derived from text
Hydrometeorology; Information Systems; Land Management; Numerical Weather Forecasting; Multiscale Models; Remote Sensing

51
LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance of animals and plants in space and related environmental conditions. For specific topics in life sciences see *categories 52 through 55*.

20100018596 Korea Advanced Inst. of Science and Technology, Taejon, Korea, Republic of

Development of the Electrochemical Biosensor for Organophosphate Chemicals Using CNT/Ionic Liquid Bucky Gel Electrode

Choi, Bong G; Park, HoSeok; Park, Tae J; Kim, Dong H; Lee, Sang Y; Hong, Won H; Apr 1, 2010; 5 pp.; In English

Contract(s)/Grant(s): FA238-608-1-4009

Report No.(s): AD-A517373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517373

Organophosphorus hydrolase (OPH) immobilized on CNT/ionic liquid (IL) electrodes were prepared by using three different intrinsic kinds of ILs, as binders. CNTs/ILs lead to dramatic electrochemical enhancements with respect to response time, stability, and sensitivity of composite electrodes. In addition, the electrochemical and biocatalytic properties of three-composite electrodes were strongly influenced by different types of ILs used, as verified by cyclic voltammetry and chronoamperometry. These results were attributed to the conformational changes of the microenvironment between the OPH and the composite electrodes within three different types of ILs. In particular, the biocatalytic signals of three OPH/CNT/ILs modified electrodes increased linearly to the concentration of paraoxon in a wide range of 2-20 lM. These findings provide a deep understanding of the role of each IL on the modified electrodes, enabling to enhance electrochemical properties for biosensors.

DTIC

Bioinstrumentation; Biological Effects; Carbon Nanotubes; Detection; Electrodes; Enzymes; Gels; Organic Phosphorus Compounds

20100018601 Bureau of Medicine and Surgery (Navy), Washington, DC USA

Navy Medicine. Volume 101, No. 1, January-February 2010

Feb 2010; 33 pp.; In English

Report No.(s): AD-A517541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517541

The new model is focused on a patient and family-centered concept of care that emphasizes a collaborative, multi-disciplinary team approach. This model will forge a partnership between the clinical team, the patient, and when appropriate, the patient's family. Civilian and military health care systems have demonstrated improved quality of care, patient satisfaction, and access to care when medical practice is organized around a primary care model that focuses on the patient and family. A standardized primary care model will improve the care team's ability to comprehensively manage their patients. This model will require innovation and new ways of thinking, working, and communicating for family medicine physicians, physician assistants, nurse practitioners, other providers, and staff members who will make up the primary care teams. Successful implementation will have to address many requirements including facility capabilities, personnel assignments, training requirements, and clear business rules. The road ahead will require strong commitment at all levels of our organization. This is a 2010 strategic priority for Navy Medicine and we are prepared to support clinicians and our patients. As we move forward in 2010, I want you to know that Navy Medicine is well-positioned for the future. We recognize that our world-wide operational demands and our commitment to provide care to our growing number of beneficiaries will continue to pose formidable challenges. But this is what we do and why so many of us chose a career in military medicine. It's also why we are guided by the Navy's Core Values, Honor, Courage, and Commitment in all we do. Navy Medicine is a world-wide health care system comprised of compassionate and talented professionals who are willing to make contributions and personal sacrifices.

DTIC

Medical Services; Military Operations; Navy

20100018602 Bureau of Medicine and Surgery (Navy), Washington, DC USA

U.S. Navy Medicine Strategic Plan

Robinson Jr , Adam M; Jan 2010; 29 pp.; In English

Report No.(s): AD-A517547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517547

This strategic plan charts the course of Navy Medicine's priorities now and for the future. It cascades accountability throughout the organization, and establishes a framework to improve the overall effectiveness and efficiency of Navy Medicine by identifying our strategic goals for the next three to five years and also by putting short-term goals and actions in place now that will allow us to reach those goals. This plan emphasizes Navy Medicine's mission, vision, and Concept of Care which define our core values and guiding principles. Our plan complements national and departmental strategic guidance and describes our vital role in national security. The foundation of Navy Medicine's strategic approach is our set of eight Tier 1 goals, which are high-level, strategic areas of priority supported by a number of Tier 2 goals that provide specific areas for action. Action plans have been developed for several of the Tier 2 goals, identifying specific tasks and timelines for achieving the goals. The real work to meet Navy Medicine's goals is done at each command by every member of Navy Medicine. Local planning activities will include development of Tier 3 goals to ensure that each command is in alignment with the strategic plan and that local activities support the overall goals. Specific metrics were developed for each Tier 1 strategic goal, with the opportunity to further develop operational-level metrics for the Tier 2 goals as action plans are established. These measures translate our strategy into operations and offer transparency across our organization on how we are closing the performance gap of our strategic initiatives. Senior leadership monitors both the Tier 1 strategic measures and the Tier 2 action plans to track progress, identify areas in need of improvement, and celebrate success.

DTIC

Medical Services; Military Operations; Navy

20100018605 CombiMatrix Corp., Mukilteo, WA USA

Targeted Deposition of Antibodies on a Multiplex CMOS Microarray and Optimization of a Sensitive Immunoassay Using Electrochemical Detection

Cooper, John; Yazvenko, Nina; Peyvan, Kia; Maurer, Karl; Taitt, Chris R; Lyon, Wanda; Danley, David L; Mar 19, 2010; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911SR-08-C-0055

Report No.(s): AD-A517612; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517612

The CombiMatrix ElectraSense(registered) microarray is a highly multiplex, complementary metal oxide semiconductor with 12,544 electrodes that are individually addressable. This platform is commercially available as a custom DNA microarray; and, in this configuration, it has also been used to tether antibodies (Abs) specifically on electrodes using complementary DNA sequences conjugated to the Abs. An empirical method is described for developing and optimizing immunoassays on the CombiMatrix ElectraSense(registered) microarray based upon targeted deposition of polypyrrole (Ppy) and capture Ab. This process was automated using instrumentation that can selectively apply a potential or current to individual electrodes and also measure current generated at the electrodes by an enzyme-enhanced electrochemical (ECD) reaction. By designating groups of electrodes on the array for different Ppy deposition conditions, we determined that the sensitivity and specificity of a sandwich immunoassay for staphylococcal enterotoxin B (SEB) is influenced by the application of different voltages or currents and the application time. The sandwich immunoassay used a capture Ab adsorbed to the Ppy and a reporter Ab labeled for fluorescence detection or ECD, and results from these methods of detection were different. Using Ppy deposition conditions for optimum results, the lower limit of detection for SEB using the ECD assay was between 0.003 and 0.01 pg/ml, which represents an order of magnitude improvement over a conventional enzyme-linked immunosorbant assay. In the absence of understanding the variables and complexities that affect assay performance, this highly multiplexed electrode array provided a rapid, high throughput, and empirical approach for developing a sensitive immunoassay.

DTIC

Antibodies; Antigens; CMOS; Deposition; Detection; Immunoassay; Immunology; Multiplexing; Polypyrroles; Sensitivity

20100018608 Wisconsin Univ., Madison, WI USA

Structural and Functional Analysis of CA125: Potential for Early Diagnosis and Understanding the Immune Evasion Strategies of Epithelial Ovarian Tumors

Patankar, Manish S; Jul 2005; 4 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0102

Report No.(s): AD-A517680; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517680

The proposed studies will define the structure and the biological function of the epithelial ovarian tumor marker MUC16 (CA125). The knowledge obtained can be utilized to develop better diagnostic tests for early detection of ovarian cancer and also to understand the pathogenesis of this disease. Due to delays in procuring the appropriate approvals from the Institutional Review Boards we have not been able to initiate the proposed studies. We therefore do not have any major findings/ accomplishments to report at this time.

DTIC

Cancer; Diagnosis; Functional Analysis; Neoplasms; Ovaries; Structural Analysis; Tumors

20100018629 Wake Forest Univ., Winston-Salem, NC USA

Pacifying the Open Abdomen with Concomitant Intestinal Fistula: A Novel Approach

Layton, Brian; DuBose, Joe; Nichols, Shawnn; Connaughton, James; Jones, Tracy; Pratt, Jerry; May 8, 2009; 4 pp.; In English

Report No.(s): AD-A517724; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517724

The management of the open abdomen, particularly when complicated by the presence of intestinal fistula, remains a significant challenge of modern trauma care. Although several approaches have been proposed, these varied and complex cases defy the application of a universal approach to local therapy. Ultimately, abdominal closure is desired but is not always possible. Accordingly, surgeons must be well versed in the application of a number of useful approaches that may serve to facilitate control of fistula drainage while permitting management of the surrounding open wound. We contribute a management approach that is simplistic in design, provides for effective fistula control, and permits the subsequent unhindered granulation of the surrounding wound in abdomens not amenable to delayed closure techniques.

DTIC

Abdomen; Intestines; Surgery

20100018653 Naval Research Lab., Washington, DC USA

Molecular Memory Circuits Using a Virus as a Template

Blum, A S; Soto, C M; Ratna, B R; Jan 2008; 4 pp.; In English

Report No.(s): AD-A517790; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517790

Significant challenges exist in constructing and manipulating the building blocks of a nanoscale device. After such a device is assembled, it is an additional challenge to electronically address or measure responses at the molecular level. We demonstrate the usefulness of individual virus particles as scaffolds to enable design, construction, and measurement of nanoscale molecular electronics memory devices. Such devices are of great interest for their potential to enable lightweight, low-cost, and low-power technologies such as handheld electronic sensors and inexpensive disposable molecular memories. Taking advantage of molecular electronics requires developing novel techniques for organizing nanosized materials into usable devices. As biological interactions are better understood, there has been great interest in using the specificity and strong interactions present in biology for this purpose. By combining the structural specificity provided by biological systems with the material properties of synthetic systems it is possible to develop novel devices on the nanoscale. Using viruses as nanoscale scaffolds for devices offers the promise of exquisite control of positioning on the nanoscale, using a particle that can either interface with lithographically defined structures, or undergo further self-assembly into extended structures by itself. We use cowpea mosaic virus (CPMV) as a nanoscale scaffold for constructing molecular electronic circuits for use in memory applications. Nanocircuit Assembly: Using genetically engineered CPMV allows the generation of specific patterns of functional amino acids, which provide a means to assemble complex structures with high spatial specificity on the nanometer scale. Using genetically engineered CPMV allows the generation of specific patterns of functional amino acids, which provide a means to assemble complex structures with high spatial specificity on the nanometer scale.

DTIC

Circuits; Computer Storage Devices; Memory (Computers); Nanotechnology; Templates; Viruses

20100018656 General Accounting Office, Washington, DC USA

Defense Health Care: 2008 Access to Care Surveys Indicate Some Problems, but Beneficiary Satisfaction Is Similar to Other Health Plans

Williamson, Randall B; Anderson, Bonnie; Kelly, Martha; Bloch, Susannah; Mangano, Peter; Mayhew, Jeff; Motley, Lisa; Smith, Jessica C; Sondhelm, C J; Worth, Suzanne; Mar 2010; 71 pp.; In English

Report No.(s): AD-A517798; GAO-10-402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517798

In fiscal year 2009, over 9 million beneficiaries were eligible to receive health care and mental health care through DOD's TRICARE program. Under TRICARE, beneficiaries have choices among various benefit options and may obtain care from either military treatment facilities or civilian providers

DTIC

Health; Medical Services; Mental Health; Surveys

20100018683 Naval Research Lab., Washington, DC USA

Plant Proanthocyanidins Bind to and Neutralize Bacterial Lipopolysaccharides

Delehanty, J B; Johnson, B J; Hickey, T E; Pons, T; Ligler, F S; Jan 2008; 8 pp.; In English

Report No.(s): AD-A517872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517872

Proanthocyanidins (PACs) are naturally occurring polymers derived from higher plants and they have recently been associated with several potential positive health benefits such as antibacterial, chemotherapeutic, and anti-atherosclerotic activities. Here we report on the binding of PACs from cranberries, tea, and grapes to lipopolysaccharide (LPS), a major component of the outer membrane of Gram-negative bacteria. LPS is the cause of several human illnesses, including sepsis and toxic shock syndrome. We show that in the case of cranberries, the majority of the LPS-binding activity is contained within a PAC fraction composed of polymers with an average degree of polymerization of 21. This PAC fraction modestly inhibits the binding of LPS to the surface of mammalian cells expressing the full complement of LPS receptors while it significantly abrogates the cellular internalization of LPS. Our results demonstrate PACs to be a new class of LPS-binding compound with potential utility in the removal of LPS from potable water sources and pharmaceutical preparations.

DTIC

Bacteria

20100018691 Texas Univ., Galveston, TX USA

Thioaptamers for Therapeutic Targeting of Pathogenic Human Proteomes

Gorenstein, David G; Luxon, Bruce; Herzog, Norbert; Aronson, Judy; Barrett, Alan; May 31, 2005; 13 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0379

Report No.(s): AD-A517892; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517892

The objective was to develop novel thioaptamers targeting NF-appaB/Ref proteins and other relevant proteins, allowing one to modulate the immune response to a BW attack. Combinatorial selection and structure-based design methods were used to develop thioaptamers to bind key proteins in response to pathogens such as hemorrhagic fever viruses and West Nile encephalitis virus. Two lead thioaptamers have been developed and tested against several viral animal models. XBY-6 bound p50 homo- or heterodimer of NF-appaB, AP-1 transcription factors. XBY-6 in liposomes prolonged the incubation period of guinea pigs infected with P18 (virulent) Pichinde arenavirus, however by 3 weeks nearly all animals were dead despite the treatment while XBY-S2 protected up to 80% of the animals from death. XBY-6 and XBY-S2 also both protected mice that were later infected with West Nile virus. Other thioaptamers were selected from in vitro aptamer libraries to bind additional NF-appaB dimers, TGF-Beta and various flavivirus envelope protein domain III proteins. In addition libraries of thioaptamers were synthesized on beads, one thioaptamer-one bead as well as library of libraries. The beads, when reacted with specific proteins, and the thioaptamers binding specific proteins were selected by flow cytometry.

DTIC

Fever; Hemorrhages; Microorganisms; Pathogens; Proteins; Proteome; Therapy; Warfare

20100018692 University of Southern Illinois, Springfield, IL USA

Effect of Stromal Adipokines on Breast Cancer Development

Woo, Richard A; Sep 2009; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W8XWH-08-1-0656

Report No.(s): AD-A517901; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517901

Obesity increases the risk of breast cancer in post-menopausal women. The degree of risk increases proportionally with an increase in adiposity. There is mounting evidence that stromal cells in the tumor microenvironment make pivotal contributions to tumor progression. Stromal adipocytes have been shown to exert their influence on breast cancer cells via two secreted adipocytokines, leptin and adiponectin. Leptin stimulates proliferation and invasiveness of breast cancer cell lines. Conversely, adiponectin is down-regulated in obese individuals, and there is an inverse relationship between adiponectin levels and risk of breast cancer. Therefore, in breast cancer development, it is important to know if there are significant interactions or tumorigenic effects of excess adipose tissue on mammary epithelium. The question of how adipocytes exert their influence on pre-malignant mammary epithelial cells has not been resolved. Adiponectin was found to suppress the effects of oncogenic ras or Myc in p53-/- MMECs. These cells slowed their rate of growth in response to adiponectin, and was better able to maintain genomic stability. This lead to reduced transformation potential in a soft agar assay. Conversely, the effects of leptin was very striking. The presence of p53 was able to suppress the oncogenic effects of ras and Myc. However, when leptin was present, oncogene-expressing WT-MMECs behaved just like p53-/- MMECs. These cells had a greatly enhanced rate of growth and became highly aneuploid. Furthermore, p53 was no longer able to function as a tumor suppressor in the presence of leptin, allowing oncogenic transformation.

DTIC

Adipose Tissues; Breast; Cancer; Mammary Glands; Obesity

20100018693 Yale Univ., New Haven, CT USA

Using Propranolol to Block Memory Reconsolidation in Female Veterans with PTSD

Aikins, Deane; Oct 2009; 5 pp.; In English

Contract(s)/Grant(s): W81XWH-08-1-0491

Report No.(s): AD-A517902; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517902

In the current study, we will be investigating a method for blocking memory reconsolidation in three groups of female Veterans of either Operation Iraqi Freedom or Operation Enduring Freedom (OIF/OEF) with PTSD. During the first year of the 3 year project, institutional review approvals were obtained from Yale University School of Medicine, VA Connecticut Healthcare System, West Haven Campus, and U.S. Army Medical Research and Materiel Command Office of Research Protection Human Research Protection Office. Patient recruitment is underway.

DTIC

Blocking; Females; Medical Science

20100018696 Providence Health Systems, Portland, OR USA

Production and Characterization of a Novel OX40 Ligand for Clinical Use

Weinberg, Andrew D; Aug 2009; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0436; PC073499

Report No.(s): AD-A517909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517909

The goals of the first year/phase of the DOD funded research, PC073499, have been accomplished. We produced two human versions of the OX40 ligand:trimer:Ig protein. The two protein constructs have different human trimer domains (TRAF2 and Matrillin-4), which confer differing folding patterns within the two-dimension structure of the protein. Both the TRAF2 and Matrilin-4 trimer domain constructs appear to have as good if not better in vitro bioactivity when compared to a mouse anti-human OX40 Ab that is currently in a clinical trial for cancer patient treatment. We have produced enough purified material to test the in vivo activity of these proteins and have planned a pilot study involving injection of these new human OX40 agonists in non-human primates. Upon completion of this project we will have important preclinical information that should allow for FDA approval of a fully human OX40 agonist to be tested in a clinical trial.

DTIC

Ligands; Proteins

20100018697 Pennsylvania Univ., Philadelphia, PA USA

Development of Lipid-Based Nanoparticles for In Vivo Targeted Delivery of Imaging Agents into Breast Cancer Cells

Popov, Anatoliy V; Oct 2009; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0716

Report No.(s): AD-A517913; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517913

Breast cancer represents a unique disease in oncology, in that specific markers have been identified and are routinely used for diagnosis and targeted therapy. Targeted delivery of a combined imaging and therapy agent to cancer cells is an avenue to develop a new generation of effective and selective anticancer agents. The goal of this proposal is to develop novel nanoparticles for in vivo breast cancer targeting. The nanoparticles consist of a cholesterol ester core surrounded with a lipid monolayer shell containing an imaging agent and metal chelating groups that can attach proteins of interest through specific His6 tagging. Thus far we have synthesized nanoparticle building blocks as well as imaging agents; optimized nanoparticles core composition that provides the minimum nanoparticles size of 8 nm; found out that shell loaded image is much more effective than core loaded one. We have prepared a number of lipid nanoparticles with His6-tagged targeting proteins, which were successfully tested in vitro for optical imaging of model cell lines. We have developing lipid nanoparticles, which are loaded with optical and MR imaging agents and coordinationally bound with different ligands for targeting HER-2/neu on breast cancer cells. In near future we will test these nanoparticles with SK-BR-3 (HER-2/neu+) and MDA-MD-468 (HER-2/neu-) breast cancer cell lines.

DTIC

Breast; Cancer; Imaging Techniques; In Vivo Methods and Tests; Lipids; Mammary Glands; Nanoparticles

20100018726 Texas Univ. Health Science Center, San Antonio, TX USA

Discovery of Newer Therapeutic Leads for Prostate Cancer

Mooberry, Susan L; Jun 2009; 8 pp.; In English

Contract(s)/Grant(s): W81XWH-08-1-0395

Report No.(s): AD-A517984; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517984

For many prostate cancer patients currently available drugs do not stop the lethal progression of the disease. There is a critical need for more effective therapies for the treatment of late-stage, metastatic prostate cancer. We will test the hypothesis that new drugs and/or drug leads for the treatment for metastatic prostate cancer can be identified from the understudied plants of Texas. In this effort we will prioritize the most promising plant extracts and then prepare large-scale quantities of the plant extracts using supercritical fluid extraction techniques and use this material for bioassay-guided fractionation of the biologically active constituents using modern chromatography techniques. The chemical structures of isolated compounds will be determined using NMR spectroscopy. Detailed biological evaluations will be conducted on compounds isolated.

DTIC

Cancer; Chemotherapy; Prostate Gland; Therapy

20100018729 Ohio State Univ., Columbus, OH USA

Functional Epitaxial Oxide Devices

Brillson, Leonard J; Volakis, John; Look, David C; Apr 12, 2010; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-08-1-1090

Report No.(s): AD-A517993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517993

This report consists of three parts: an Ohio State Electrical & Computer Engineering /Physics component, an Ohio State Electrosciences component, and a Wright State component. This research effort addresses the need for high performance radio frequency (RF) components, specifically varactors and miniaturized, high gain, high bandwidth antennas. This program encompasses materials design, growth, processing, and physical characterization to develop varactor and antenna components with low dielectric loss. This program of research represents the second stage of the MultiFunctional oxide Materials, their Applications (MFMA) and devices initiative, which seeks to leverage Ohio strengths in oxide materials, magnetics and telecommunications into state-of-the-art electromagnetic technology that can revolutionize products in communications, sensors, and radar. Functional epitaxial oxide devices based on MFMA technology can enhance telecommunication (both wired and wireless, and optical), present-day computers, and provide technologies for nonvolatile data storage, sensors for defense and commercial application. This Ohio effort coordinates with complementary growth, characterization and device

fabrication activities of Prof. Hadis Morkoc at Virginia Commonwealth University.
DTIC
Detectors; Epitaxy; Oxides

20100018742 Fox Chase Cancer Center, Philadelphia, PA USA
A New Therapeutic Paradigm for Breast Cancer Exploiting Low Dose Estrogen-Induced Apoptosis
Jordan, Virgil C; Sep 2009; 339 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0590
Report No.(s): AD-A518016; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518016

The purpose of the CoE is to discover the mechanism(s) of estrogen-induced apoptosis in advanced antihormone-resistant breast cancers using our unique models, and to establish the clinical value of short-term low-dose estrogen to reverse antihormone resistance in patients exhaustively treated with antihormone therapy. The clinical trial has begun enrolling patients, but enrollment has been low. We have addressed this by amending patient eligibility and expanding trial site locations. We have completed gene expression microarray hybridizations covering extended E2-treatment time courses of wild-type MCF-7:WS8, and of estrogen deprivation-resistant MCF-7:5C and MCF-7:2A cells, which undergo E2-induced apoptosis. Multiple custom methods have been developed for analyses of time-course microarray data. We have also conducted proteomic analyses, and identified proteins which differentially co-immunoprecipitate with the co-activator AIB1 or phospho-tyrosine complexes in an E2-dependent manner. Using the gene expression microarray and proteomic data, networks were built that highlight differential growth versus apoptosis pathways regulated by E2. Further, based on the microarray analyses, we investigated the G protein coupled-receptor GPR30, and the endoplasmic reticulum stress-associated factors caspase-4 and XBP1 in E2-induced growth or apoptosis. Finally, we surprisingly found that long-term treatment of MCF-7:5C cells with the c-Src inhibitor PP2 reversed E2-induced apoptosis.
DTIC
Apoptosis; Breast; Cancer; Dosage; Estrogens; Mammary Glands; Therapy

20100018745 Mount Sinai Hospital, Toronto, Ontario Canada
Genetic and Molecular Analysis of the Mechanisms by which TSC Regulates Neuronal Differentiation
McNeill, Helen; Mar 2009; 34 pp.; In English
Contract(s)/Grant(s): W81XWH-08-1-0154
Report No.(s): AD-A518029; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518029

Loss of TSC pathway components alters the timing of neuronal differentiation in the Drosophila eye and wing imaginal disc. To determine the mechanisms underlying this regulation of neuronal differentiation, we have 1) further defined the subtypes of photoreceptors that respond to loss of TSC, 2) tested candidates for the regulation of differentiation in the eye, Our data indicate that loss of TSC does not control neural differentiation through 5' TOP elements contained in the mRNA of proneural genes examined (CG11799, echinoid, moleskin, src). Consistent with this conclusion, our genetic analysis ofthe Drosophila homolog of polypyrimidine tract binding protein, Hephaestus, indicates that loss of Hephaestus does not alter the timing of differentiation of photoreceptors in the eye. We conclude therefore that alternate mechanisms control this process. Our epistasis analysis indicates that S6K is essential for the precocious differentiation seen in TSC clones, while loss of eIF4E does not affect the timing of differentiation. The Ecdysone receptor (Ecr) pathway also regulates the timing of differentiation in the eye. Our genetic analysis indicates that EcR functions in a parallel pathway to TSC in the timing of differentiation.
DTIC
Brain; Diseases; Genetics; Neurophysiology

20100018746 Yale Univ., New Haven, CT USA
Genomic Instability and Breast Cancer
Chen, Junjie; Oct 2009; 124 pp.; In English
Contract(s)/Grant(s): W81XWH-05-1-0470
Report No.(s): AD-A518030; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518030

We are investigating the regulation of genomic stability and how the disruption of such regulation contributes to breast cancer development. We have performed in-depth studies of BRCA1 and the DNA damage response, which allow us to

propose a new model of DNA damage signaling pathways and how it functions to ensure genomic stability in response to DNA damage. In addition, we are continuing our purification of protein complexes for the study of cell cycle and DNA damage networks involved in breast cancer development. We have identified several new components involved in DNA damage repair or mitotic progression. While some of these studies are still ongoing, we have already made several exciting findings and published some of them recently. We hope that these studies will help us to understand breast cancer etiology and discover new targets for cancer treatment.
DTIC
Breast; Cancer; Deoxyribonucleic Acid; Genome; Mammary Glands

20100018748 Massachusetts Inst. of Tech., Cambridge, MA USA
Identification of Putative Metastasis Suppressor MicroRNA in Human Breast Cancer
Valastyan, Scott; Nov 2009; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0788
Report No.(s): AD-A518036; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518036

Metastases are responsible for 90% of human cancer deaths; yet, our knowledge regarding the molecular regulation of metastasis remains fragmentary. MicroRNAs are short RNAs that suppress their targets post-transcriptionally, leading to modulation of diverse biological processes. MicroRNAs are well suited to regulate metastasis due to their capacity to concomitantly inhibit numerous target genes. We have identified a microRNA, miR-31, whose levels correlated inversely with metastatic recurrence in human breast cancer patients. Expression of miR-31 in otherwise-aggressive breast tumor cells impeded metastasis. We deployed a novel microRNA sponge strategy to stably inhibit miR-31; this allowed otherwise-non-aggressive breast cancer cells to metastasize. These phenotypes were achieved via pleiotropic modulation of a cohort of clinically relevant metastasis-promoting genes, which were over represented among the 200 mRNAs predicted to be direct targets of miR-31. In fact, we discovered that miR-31-evoked concurrent regulation of three such effectors - integrin alpha5, radixin, and RhoA - was sufficient to explain this microRNA's impacts on metastasis. Together, these findings provide insights into metastasis that may prove useful in the diagnosis and/or treatment of breast cancer.
DTIC
Breast; Cancer; Mammary Glands; Metastasis; Ribonucleic Acids; Suppressors

20100018751 National Defense Univ., Washington, DC USA
The Military Health System(s): Separate But Equal
Lane, David A; Jan 2007; 6 pp.; In English
Report No.(s): AD-A518042; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518042

Joint operations are the baseline of all future military activities. Yet the Services continue to operate their own health care systems that, at best, cooperate with each other in providing benefit and readiness missions to eligible patients during peace and war. Despite numerous recommendations for organizational change to improve resource efficiency and operational responsiveness, the Military Health System (MHS) structure has evolved little since World War II. The Services operate relatively separate but equal deployable medical systems to support deployed combat forces. As called for in Joint Vision 2020, current resource shortages and threats in the security environment demand revolutionary innovations. By leveraging existing transformation efforts and creating a unified U.S. Medical Command--headed by a four-star medical force commander with subordinate Service and TRICARE components--the MHS can achieve the resource efficiency and operational flexibility needed to change both how it provides force health protection to combat forces and brings all players together to carry out its benefit and readiness missions. The MHS is one of the largest and most complex health care organizations in the USA. Its mission is to enhance DoD and our nation's security by providing health support for the full range of military operations and sustaining the health of all those entrusted to our care. In operating its network of 76 hospitals and more than 500 medical and dental clinics, the MHS is a $28 billion annual enterprise that cares for almost 9 million patients, including nearly 1.5 million uniformed personnel. There are two parts to the MHS health support mission: the readiness and benefit components. The readiness component, or force health protection, includes fit and healthy force maintenance, casualty prevention, and casualty care management.
DTIC
Health; Management Systems; Medical Services; Military Operations

20100018755 Army War Coll., Carlisle Barracks, PA USA

Confronting Combat Stress Reactions

Davis, III, Archie P; Mar 22, 2010; 57 pp.; In English

Report No.(s): AD-A518051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518051

The continuous deployment of our forces over the past 8 plus years has resulted in an alarming increase in the number of Soldiers developing symptoms of, or being diagnosed with, Traumatic Brain Injury (TBI), Post-Traumatic Stress Disorder (PTSD), or symptoms of long-term major depression. There are growing concerns regarding repeated deployments and the cumulative effects of combat stress reactions experienced by our forces that could eventually result in a significant reduction in the total number of Soldiers being available to support future conflicts. Senior leaders must rapidly recognize the stressors placed on the mental health and well-being of our Soldiers and their Families. Increased efforts are required to change both the mindset and culture of our senior leaders to ensure that adequate measures and programs are implemented to both support and assist our veterans, Soldiers, and Families in tackling these conditions now and in the future. Also, because of future post-conflict budget cuts, the Army has elected to execute internal initiatives while fighting two wars which prevents Soldiers from effectively seeking needed quality health care and spending necessary time with their families. Other topics that this paper addresses are as follows: Historical Findings that Brought Mental Health Disorders to the Forefront; PTSD, TBI, and Major Depression in Male and Female Soldiers Returning from Iraq and Afghanistan; Stigmas Causing Soldiers to Avoid Seeking Mental Health Care Services; Mental Health Conditions Are Also Affecting Senior Leaders; Inexperienced Leaders Are Being Thrust Into the Role of Making Critical Decisions Because the Army Cannot Retain Enough Mid-Grade Officers; Cumulative Effects Impacting Families; Changing Our Culture to Embrace Growing Medical Conditions; Overhauling VA to Support the Mental Health Care Needs of Our Veterans; and Recommendations.

DTIC

Armed Forces (United States); Brain Damage; Combat; Deployment; Mental Health; Military Personnel

20100018759 Army War Coll., Carlisle Barracks, PA USA

Towards an Operational Force: Health Readiness in the Army Reserve

Eddy, John; Mar 24, 2010; 29 pp.; In English

Report No.(s): AD-A518062; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518062

This research will critically review current health readiness practices within the Army Reserve and recommend sourcing and systems changes to position it for transformation from a strategic to an operational reserve. This will be accomplished in accordance with the provisions of DoDD 1200.17 Managing the Reserve Components as an Operational Force. Recommendations will support selected changes in Army Reserve culture, legislative initiatives, full-time manning, force structure, and the role and responsibilities of the command surgeon.

DTIC

Armed Forces (United States); Health; Maintainability; Military Personnel; Personnel Management; Reserves

20100018782 Rochester Univ., NY USA

The Isolation and Characterization of Human Prostate Cancer Stem Cells

Palapattu, Ganesh S; Aug 2009; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0508; PC073121

Report No.(s): AD-A518099; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518099

The overall objective of this proposal is to develop a durable cure for lethal prostate cancer through the elucidation of the role of cancer stem cells in the pathogenesis of the disease. During the past year, we have made the following significant findings: i) CD44, a putative prostate cancer stem cell marker, is localized to neuroendocrine cells in prostate cancer, ii) employing a specific feeder layer, it is possible to model prostate cancer initiation in vitro and iii) classic tissue recombination utilizing primary human prostate cancer cells, to the recapitulate the human disease, does not work. We are currently working to optimize and validate our in vitro model of prostate cancer initiation to facilitate cancer stem cell discovery as well as drug targeting.

DTIC

Cancer; Isolation; Prostate Gland; Stem Cells

20100018783 Research Foundation for Mental Hygiene, Inc., Menands, NY USA

Epigenetic Regulation of Autism-Associated Genes by Environmental Insults: Novel Associations

Spinner, Daryl; LaFauci, Giuseppe; Kerr, Daniel; El Idrissi, Abdeslem; Aug 1, 2009; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0207

Report No.(s): AD-A518103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518103

We hypothesized that exposure to environmental factors could impact gene expression in the brain and could play a key role in environmental-induced cases of autism. Accordingly, we established mouse embryonic cortical cultures of neurons and astrocytes, and exposed them to commonly occurring epigenetic modifying agents. To study the effects of such exposure on the methylation status of neuronal and astrocytes DNA, we designed primers for bisulfite DNA sequencing and methylation specific PCR of CpG islands of autism-associated genes, Bdnf, Gad67, Mecp2, and Reln). To study the effects of environment exposure on gene expression, we used RT Real Time PCR. mRNA from primary neurons was reverse transcribed and used in the assays. DNA samples from primary neurons treated as reported was prepared and frozen. They will be analyzed by BS and MSP.

DTIC

Cognition; Disorders; Genes; Mental Health; Psychology

20100018785 Beth Israel Deaconess Medical Center, Boston, MA USA

Development of Complement Inhibitors to Limit Tissue as Adjuvants to Resuscitation

Juang, Yuang-Taung; Mar 2010; 102 pp.; In English

Contract(s)/Grant(s): W81XWH-07-1-0286

Report No.(s): AD-A518111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518111

We have produced evidence to urge the development of six new drugs/biologics to use in battlefield injury. We have We have established that DAF limits tissue injury and moved it to large animals of polytrauma injury. We have defined the importance of C5a in tissue injury and we have recommended that C5a inhibitors may be of value in limiting tissue injury. Finally we have introduce a novel inhibitor, CRIg, in the field of tissue injury. We have established that T cells and B cells are important in the execution of injury. We have demonstrated the importance of Annexin IV in instigating tissue injury. A discovery approach has revealed yet novel targets that may limit tissue injury. Our first finding was that actin polymerization is important for the expression of tissue injury. While ourselves are moving some of them to the next phase, we believe that the information that we have published will be of value to the industry and government agencies in carrying on large animal and clinical studies.

DTIC

Inhibitors; Injuries; Resuscitation

20100018788 Michigan Univ., Ann Arbor, MI USA

A Search for Gene Fusions/Translocations in Breast Cancer

Chinnaiyan, Arul M; Oct 2009; 71 pp.; In English

Contract(s)/Grant(s): W81XWH-08-1-0110; BC075023

Report No.(s): AD-A518123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518123

We have undertaken a systematic evaluation of breast cancer to map disease-specific, recurrent chromosomal or transcriptional chimeras in breast cancer towards development of novel biomarkers and therapeutic targets. Analysis of in-house and publicly available gene expression and array comparative genomic hybridization (aCGH) data lead to the discovery that a subset of estrogen receptor positive breast cancers overexpress angiotensin II receptor, type 1 (AGTR1). In experimental model systems- both in vitro as well as in xenografts in mice, AGTR1 overexpressing breast cancers are sensitive to losartan, an AGTR1 antagonist that is used to treat high blood pressure. These studies published recently in PNAS have generated much interest in the community and will be followed up by us and others. Towards systematic gene fusion discovery, we have developed paired end transcriptome sequencing protocols and bioinformatic pipeline to nominate gene fusion candidates, also published recently in PNAS. Promising gene fusion candidates from breast cancer cell lines and tissues will be followed up in recurrence screens and functional characterization. Another major advance this year has been the discovery

of the role of micro RNA 101 in regulating the expression of histone methyltransferase EZH2 in aggressive breast and prostate cancer, published in Science.
DTIC
Breast; Cancer; Genes; Mammary Glands

20100018789 James A. Haley VA Hospital, Tampa, FL USA
Pathogenesis of Heterotopic Ossification in Traumatic Brain Injury
Heinzel, Frederick P; Li, Xin; Dec 2009; 12 pp.; In English
Contract(s)/Grant(s): W81XWH-08-2-0065
Report No.(s): AD-A518124; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518124

Heterotopic ossification (HO) is the pathologic formation of bone in soft tissues. HO develops during the physical rehabilitation of patients with traumatic injuries, such as brain, spinal cord or orthopedic injury. When adjacent to joints or pressure points, HO causes pain, pressure sores and physical obstruction that significantly limits rehabilitation. The incidence is as high as 50% after traumatic amputation due to blast injury, when the amputation is through damaged soft tissue. Much of the clinical management of HO has been empiric. We show that an atraumatic mouse model of subcutaneous HO reproduces essential features of clinical HO in humans. (1) There is an early inflammatory phase, (2) HO progresses towards bone maturity and (3) damaged soft tissue promotes local HO development. Preliminary attempts to activate osteoclast resorptive function in vivo failed, probably due to insufficient bioavailability and the rapid decline of osteoclast numbers after 2 weeks. Our observations show that this mouse model of HO an accessible and clinically relevant system for detailed in vivo analysis of HO pathogenesis and treatment. The mechanism of wound-exacerbated HO progression in mice may usefully inform the medical care of HO in amputated limbs. In the next 6 months we propose to confirm that COX2 inhibitors prevent HO progression in this model and to determine if FDA-approved vascular endothelial growth factor antagonists will disrupt endothelial formation and COX2 expression that are necessary for new bone formation in this mouse model.
DTIC
Brain; Brain Damage; Injuries; Pathogenesis

20100018829 Cornell Univ., NY USA
Radioimmunotherapy (RIT) Dose-Escalation Studies in Prostate Cancer Using Anti-PSMA Antibody 177Lu-J591: RIT Alone and RIT in Combination with Docetaxel
Vallabhajosula, Shankar; Oct 2009; 9 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0884
Report No.(s): AD-A518243; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518243

In the fall of 2007, we started the phase I dose escalation studies with 177Lu-DOTA-huJ591 monoclonal antibodies (mAb) using dose fractionation regimen. In patients with PCa and who have recurrent and/or metastatic disease, 177Lu dose (20-40 mCi/m2) was escalated in 5 different dose levels (3-6 patients at each dose level). At each dose level, the patients received two doses of 177Lu-J591 mab (20 mg/dose), 2 weeks apart. A total of 22 patients have been treated and the MTD with the dose fractionation is regarded as 40 mCi/m2 dose given twice two weeks apart. The results of this study clearly demonstrate that administration of 177Lu-J591 treatment dose in a fractionated dose regimen is relatively safe with reduced hematologic toxicity than a single dose treatment. Building upon this data, a phase I fractionated-dose 177Lu-J591 plus docetaxel, has begun enrollment. This protocol represents the intent of the SOW-4 in the original grant application. Patients will receive docetaxel, 75 mg/m2 every 21 days As of July 2009, two patients were recruited in group 1 (20 mCi/m2). Due to protocol amendments, the revised protocol was resubmitted to HSRRB for review. We plan to complete recruitment in this trial before September 2010.
DTIC
Antibodies; Cancer; Dosage; Prostate Gland

20100018830 Louisiana State Univ., Shreveport, LA USA
Dendritic Cell-Based Genetic Immunotherapy for Ovarian Cancer
Mathis, James M; Dec 1, 2008; 91 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0055
Report No.(s): AD-A518244; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518244

Adenovirus (Ad)-mediated transduction of dendritic cells (DCs) is inefficient because of the lack of the primary Ad

receptor, CAR. CD40 is a surface marker expressed by DCs that plays a crucial role in their maturation and subsequent stimulation of T cells. DC infection with Ad targeted to the CD40 results in increased gene transfer. Cells transduced with CD40-targeted Ad5-SV40-TAg vector showed increased expression of transgene and expression of co-stimulatory molecules at 48 hours post-infection compared to cells transduced with untargeted Ad5-SV40-TAg vector. We demonstrated that CD40-targeted gene transfer promotes DC maturation with induction of a complex signaling cascade accompanied by characteristic changes in cytokine production. These results demonstrate that DCs can be successfully transduced using a CD40 targeted adenoviral vector and that transduced DCs show activation.
DTIC
Cancer; Genetics; Ovaries

20100018831 Georgetown Univ., Washington, DC USA
Internet-Based Education for Prostate Cancer Screening. Addendum
Taylor, Kathryn L; Dec 2009; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0182
Report No.(s): AD-A518245; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518245

Prostate cancer (PCa) is the leading cancer diagnosis among men and the second leading cause of male cancer death. However, screening asymptomatic men remains controversial, as early diagnosis and treatment of PCa has not yet demonstrated reduced disease-related mortality in a randomized trial. The goal of the current study is to develop and assess widely accessible, easily disseminable methods to assist men in making informed decisions about PCa screening. We will compare the efficacy of a new web-based, interactive decision support approach to our existing print-based PCa screening decision tool, among a diverse sample of male primary care patients. Abundant evidence documents the expanding role of the Internet in increasing access to and understanding of health information and the need for systematic evaluations of Internetbased interventions. The print- and web-based interventions have been completed and we have accrued 1,710 participants to the randomized trial. In the final year of funding, we will accrue the remaining 165 participants, continue to follow the enrolled participants, and conduct data analyses.
DTIC
Cancer; Education; Internets; Prostate Gland

20100018832 Stanford Univ., Stanford, CA USA
Interactions Between Vitamin D and Breast Cancer
Feldman, David; Carlson, Robert; Sep 2009; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-1-0637
Report No.(s): AD-A518246; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518246

Thus far we have recruited 36 breast cancer (BCa) patients of the planned total of 50 subjects. The women were stratified according to their circulating vitamin D status [25(OH)D] and treatment was dependent on their level of 25(OH)D. Of the 36 patients 15 did not receive treatment, 14 received 2000 IU of vitamin D, 5 received 4000 IU and 2 received 6000 IU. The dosing strategy changed during the trial, the current protocol based on circulating levels of vitamin D: 40 ng/mL no treatment, 30-40 get 2000 IU, 20-30 get 4000 IU, 20 get 6000 IU. We have analyzed the biopsy samples (pre-intervention) and compared results with the surgical specimens (postintervention) to determine whether dietary vitamin D supplements can regulate the gene expression profile in the BCa and normal cells. This has been completed in 20 subjects. The eventual analysis will determine whether vitamin D deficiency is associated with a poor prognosis profile and whether vitamin D intervention converts the profile toward a more normal profile of gene expression, perhaps representing a better prognosis.
DTIC
Breast; Calciferol; Cancer; Mammary Glands

20100018833 Virginia Univ., Charlottesville, VA USA
High Resolution Anatomic and Elastographic Transrectal Ultrasound for Improved Diagnosis of Prostate Cancer
Hossack, John A; Aug 1, 2008; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0240
Report No.(s): AD-A518247; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518247

Existing Digital Rectal Examination (DRE) and PSA blood test have inadequate sensitivity and specificity in the

diagnostis of prostate cancer. In this work, we perform ultrasound elasticity imaging, using a slightly inflated latex sheath (to provide a source of moderate pressure) over the transrectal ultrasound probe. The elasticity image is generated by cross-correlating successive raw radio frequency image data sets for incrementally increasing pressure. Strain, related to elasticity, can be calculated from the displacement image. Our second objective is to use a new freehand 3D acquisition approach to obtain 3D image data sets. This approach uses a slightly modified transducer and an image motion tracking technique. Excellent progress has been made with respect to the Statement of Work and three of four total Specific Aims. A specialized transducer has designed, ordered and received. This transducer provides unsurpassed prostate scanning resolution by virtue of its exceptionally high frequency - up to 14 MHz. Prototype phantoms and complete ultrasound test instrumentation has been assembled. Preliminary ultrasound image speckle reduction work has been performed. Preliminary, dimensionally accurate, 3D prostate phantom images have been produced.
DTIC
Anatomy; Cancer; Diagnosis; High Resolution; Prostate Gland; Ultrasonics

20100018834 Fox Chase Cancer Center, Philadelphia, PA USA
MR-Guided Pulsed High-Intensity Focused Ultrasound Enhancement of Gene Therapy Combined With Androgen Deprivation and Radiotherapy for Prostate Cancer Treatment
Chen, Lili; Sep 2009; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0469
Report No.(s): AD-A518248; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518248

This work is aimed to study MR guided high intensity focused ultrasound (MRgHIFU) enhancement of gene therapy for Prostate Cancer. The first statement of work is to determine if high intensity focused ultrasound (HIFU) increases the cellular uptake of AS-MDM2, AS-bcl-2 and AS-PKA, thereby suppressing MDM2, bcl-2 and PKA, respectively, in vivo. The tasks include (a) Characterization of the output of the focused ultrasound unit using MR guidance; (b) Determination of the uptake of AS-bcl-2 in orthotopically grown LNCaP tumors; (c) Determination of the timing of the reduction in MDM2 in orthotopically grown LNCaP tumors;(d) Statistical assessment of targeted antisense therapy on gene expression in tumor bearing mice. We performed phantom studies on characterization of the output of the focused ultrasound unit using MR guidance. The IACUC protocol has just been approved by the USAMRMC Animal Care and Use Review Office (ACURO) for the use of mice. Now we are able to perform the animal studies.
DTIC
Augmentation; Cancer; Deprivation; Gene Therapy; Hormones; Males; Prostate Gland; Radiation Therapy; Ultrasonic Radiation; Ultrasonics

20100018835 Cornell Univ., NY USA
Orai1 as New Therapeutic Target for Inhibiting Breast Tumor Metastasis
Huang, Xin-Yun; Sep 2009; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0632
Report No.(s): AD-A518249; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518249

The major cause of death of cancer patients is tumor metastasis, that is, the spreading of tumors from the primary site to secondary sites. Thus development of drugs targeting this spreading process is desirable. Cell migration is one of the key steps in tumor spreading. Therefore it is very likely that inhibitors of cell migration can block tumor metastasis. Orai1 and STIM1 proteins have been recently identified to be involved in calcium influx from the extracellular environment to the inside of cells. We show here that Orai1 and STIM1 are required for tumor cell migration, invasion and tumor metastasis. Hence, Orai1 and STIM1 are potential targets for therapeutic intervention to inhibit tumor metastasis.
DTIC
Breast; Cancer; Mammary Glands; Metastasis; Targets; Therapy; Tumors

20100018836 Nebraska Univ., Omaha, NE USA
Molecular Mechanism of Lymph Node Metastasis in Breast Cancer
Singh, Rakesh K; Sep 2009; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0652
Report No.(s): AD-A518252; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518252

Many challenges exist in the current management of metastatic breast cancer as there are fewer recognized therapeutic

strategies. Therefore, a better understanding of the molecular events in the metastatic process is critical. Several reports have described correlation of hyaluronan (HA) with initiation and progression of various types of epithelial cancers. The HA synthase (HAS) isoforms encode the enzymes that produce and deposit HA while the hyaluronidase (HYAL) genes code for enzymes that degrade HA and their expression is dysregulated in various tumors as a result of transcriptional and epigenetic changes that accompany progression. In this report, we examined the expression of HAS1, HAS2 and HAS3, HYAL1 and HYAL2 and LYVE1 in mammary tumor cell with different metastatic potential (4T1, highly metastatic; Cl66, moderately metastatic; Cl66M2, low metastatic). We observed increased expression of HAS1, HAS2 and HAS3 as well as HAYL 1 and HAYL2 in aggressive mammary tumor cells. Next we stably knocked-down HAS2 and HAS3 expression and overexpressed LYVE1 in 4T1 cells and analyzed cell proliferation, migration, tumor growth and metastasis. We observed that Has2/Has3 knock-down and LYVE1 overexpression modulated mammry tumor growth and spontaneous metastasis. Together, these data demonstrate an important role of HAS2 and LYVE1 in mammary tumor growth, angiogenesis, invasion, and metastasis.
DTIC
Angiogenesis; Breast; Cancer; Epithelium; Genes; Lymphatic System; Mammary Glands; Metastasis

20100018837 Geneva Foundation, Lakewood, WA USA
Brain Vulnerability to Repeated Blast Overpressure and Polytrauma
Long, Joseph B; May 2009; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-2-0018
Report No.(s): AD-A518255; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518255

It is likely that the mild TBI and cognitive impairments observed among many of the troops returning from OIF and OEF result from repeated exposures to blast overpressure. Although the clinical symptoms of concussion are typically transient, there is both a cumulative risk for persistent damage due to repeated concussions, and a post-concussion period of greatest vulnerability to a second impact. Specific risk assessments and guidelines should be established for exposure to blast overpressure. We are using a preclinical model of blast overpressure in rats to investigate the cumulative effects of multiple blast exposures on neurologic status, neurobehavioral function, and brain histopathological endpoints. Repeated exposures to blast overpressure with varied inter-blast intervals are used to characterize and define the temporal window of brain vulnerability to repeated blast overpressure. We anticipate that these data will provide a critical first step in establishing rational risk guidelines and developing mitigation strategies.
DTIC
Brain; Overpressure; Vulnerability

20100018839 Evanston Northwestern Healthcare Research Inst., Evanston, IL USA
Role of p53 in Mammary Epithelial Cell Senescence
Dimri, Goberdhan P; May 1, 2009; 71 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0509
Report No.(s): AD-A518262; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518262

The tumor suppressor p53 plays an important role in a variety of cancers including breast cancer. It inhibits the growth of malignant cells either by inducing G1 arrest, apoptosis, senescence or autophagy. In this career development award, we studied the role of p53 in human mammary epithelial cell (HMEC) senescence and the requirement of p53 inactivation in transformation of HMECs. First, we determined that p53 binding activity increases with senescence in post-selection HMECs, and expression of its targets such as p21 is increased in post-selection senescent cells. We also found that there were no major differences in acetylation or phosphorylation of p53 in pre-selection and post-selection HMECs. However, there is a modest increase in acetylated p53 in post-selection senescent HMECs. Next, we studied the role of p53 in HMEC senescence using RNAi approach. Our studies suggested that p53 or p21 knockdown results in bypass of senescence in HMECs. We also carried out an array analysis of p53 targets in early passage (proliferating) and late passage (senescent) post-selection HMECs. Next, we studied the role of additional targets of p53 in HMEC senescence using RT-PCR analysis and identified additional targets of p53 using ChIP assay. Finally, we studied p53/p21 pathway in BMI1+H-RAS transformed HMECs, and the role of p53 in oncogene-induced senescence (OIS) in HMECs.
DTIC
Aging (Biology); Breast; Cancer; Epithelium; Mammary Glands

20100018840 California Univ., Los Angeles, CA USA

UCLA High Speed, High Volume Laboratory Network for Infectious Diseases. Addendum

Layne, Scott P; Godwin, Hilary; Miller, Jeffrey F; Aug 2009; 83 pp.; In English

Contract(s)/Grant(s): W81XWH-07-2-0015

Report No.(s): AD-A518266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518266

Objectives/Hypothesis: This project aims to develop a new kind of high-throughput laboratory and informatic capability. It will provide a platform (high-speed high-volume processing, accessioning, archiving, screening, genotyping, culturing, phenotyping) for data-driven science and discovery. This platform is first being developed for influenza and can be expanded to include other pathogens as well. Integrated bioinformatics will associate surveillance information from the field with laboratory data and enable data-driven science and discovery against emerging and engineered biothreats. Specific Aims: With FY06 (Initial Year), FY07 (OY1) and FY08 (OY2) Congressional appropriations, high-throughput bioagent Automated Genotyping System has been implemented first and are currently in the process of purchasing an initial unit of the Automated Archiving System. In addition, 100% specifications for both the Automated Culturing System and Automated Screening System have been produced; RFPs have been released by UCLA Purchasing in February 2010. The Automated Screening System will be purchased with OY2 funds. With FY09 (OY3) Congressional appropriations, the Automated Culturing System will be purchased. In addition, OY3 funds will be used to complete specifications for the Automated Phenotyping System. If FY10 (OY4) Congressional appropriations are approved (or if other funds become available), these funds will be used to purchase the Automated Phenotyping System and two additional units of the Automated Archiving System. The automated systems will be housed in laboratory space at UCLA that has been upgraded to BSL3-enhanced (BSL3e) containment (to be completed in OY2) that enables the flow of numerous samples containing Highly Pathologic Avian Influenza and other Select Agents (dual-use).

DTIC

Computer Networks; High Speed; Infectious Diseases

20100018841 Army Research Inst. of Environmental Medicine, Natick, MA USA

Graphical User Interface for a Remote Medical Monitoring System: U.S. Army Medic Recommendations

Kaushik, Sangeeta; Tharion, William J; Nov 2009; 7 pp.; In English

Report No.(s): AD-A518267; M09-10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518267

The U.S. Army is developing a far-forward medical monitoring system to provide medical information to medics and other medical personnel that are geographically removed from Soldiers they are monitoring. This system, termed the Warfighter Physiological Status Monitoring (WPSM), consists of a wearable sensor suite that allow remote health assessment of a Soldier.

DTIC

Detection; Graphical User Interface; Medical Services; Remote Sensing

20100018882 Science and Technology Corp., Hampton, VA USA

Production of Murine Monoclonal Antibodies using Traditional and Novel Technology

Dixon, Melissa M; Mar 2010; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-6007-C08

Report No.(s): AD-A518298; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent attempts to generate monoclonal antibodies against various biological immunogens have proven to be successful. This report discusses the traditional and novel technologies used to produce monoclonal antibodies. Hybridoma monoclonal antibodies are highly specific antibodies produced in large quantities by cloning a single hybrid cell formed by the fusion of a murine B cell and a tumor cell. Recent attempts to generate monoclonal antibody against Ricin B-Chain and Ovalbumin have proven to be successful. After a pre-determined immunization period, the murine spleens containing the B cells are harvested and fused together with a tumor cell (SP2/0) to generate the first round of monoclonal cells. Subsequent screenings are conducted using the enzyme linked immuno sorbent assay (ELISA) followed by additional cloning steps. The resulting cell lines are stable, monoclonal hybridomas. The supernatant generated from the cell lines are protein purified and tested via ELISA for cross-reactivity. The final product is a hybridoma monoclonal antibody specific to the target for which it was originally immunized.

DTIC

Antibodies; Rodents

20100018884 University of Pittsburgh Medical Center, PA USA

A National Model for Diabetes Prevention and Treatment Program in Civilian and Military Healthcare Beneficiary Populations

Barnes, Barbara E; Siminerio, Linda; Krall, Jodi; Mar 2010; 240 pp.; In English

Contract(s)/Grant(s): W81XWH-07-2-0080

Report No.(s): AD-A518312; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reduction in the incidence of diabetes and alleviation of its complications has become a national public health priority. The University of Pittsburgh Medical Center, in partnership with the USA Air Force, sought to determine the best methods for preventing diabetes and improving diabetes care. We hypothesized that evidence-based pediatric and adult primary prevention and management programs would reduce risk for diabetes and its complications in civilian and military populations. For these respective populations, we (1) delivered a comprehensive 5-year strategic plan (2) implemented a primary prevention and management system for childhood obesity; (3) implemented primary prevention by disseminating the modified Diabetes Prevention Program strategies through different modalities; (4) implemented diabetes programs based on the Chronic Care Model and (5) investigated and evaluated implementation of glycemic management protocols inpatient setting. A multifaceted approach was used with a comprehensive multifaceted approach was used with a comprehensive analysis plan.

DTIC

Metabolic Diseases; Obesity; Populations; Prevention; Protocol (Computers); Public Health

20100018888 Brigham and Women's Hospital, Boston, MA USA

Using Genetics and Genomics for the Detection and Treatment of Breast Cancer

Elledge, Stephen J; Sep 2009; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0638

Report No.(s): AD-A518342; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The evolution of human cells into malignant derivatives is driven by the aberrant function of genes that positively and negatively regulate various aspects of the cancer phenotype, including altered responses to mitogenic and cytostatic signals, resistance to programmed cell death, immortalization, neoangiogenesis, and invasion and metastasis(1). The integrity of these gene functions is compromised by substantial genetic and epigenetic alterations observed in most cancer cell genomes. To understand the tumorigenic process, it is imperative to identify and characterize the genes that provide tumor cells with the capabilities requisite for their initiation and progression. However, the identities of those genes that contribute to the tumor phenotype are often concealed by the frequent alterations in genes that play no role in tumorigenesis. Identifying genes that restrain tumorigenesis (tumor suppressors) has proven especially challenging due to their recessive nature. Further complicating their discovery are the multifaceted mechanisms by which tumor suppressor genes are inactivated including changes in copy number and structure, point mutations, and epigenetic alterations(2). Moreover, the mechanisms by which tumor suppressor genes are inhibited may vary between tumors. With this in mind, a variety of molecular and cytogenetic technologies have been used to establish extensive catalogs of genetic alterations within human cancers(3,4). And while it is generally accepted that highly recurrent aberrations signify changes that are important for tumor development, the causal perturbations underlying tumor genesis are often confounded by the extensive size of alterations and the large number that are incidental to the tumor phenotypes. As such, new strategies to delineate genes with functional relevance to tumor initiation and development are essential to understanding these processes.

DTIC

Breast; Cancer; Detection; Genetics; Genome; Mammary Glands; Neoplasms; Suppressors; Tumors

20100018889 Wisconsin Univ., Madison, WI USA

Use of Bifunctional Immunotherapeutic Agents to Target Breast Cancer

Carlson, Coby B; Weir, April; Dykhuizen, Emily C; Dec 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0466

Report No.(s): AD-A518343; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An anti-cancer strategy has been developed that relies on a synthetic ligand to 1)specitically target the cell surface, 2)recruit antibodies to the tumor cell, and 3) subsequently initiate a cytotoxic immune response. This small-molecule is composed of two distinct motifs: an RGD peptomimetric that binds with high affinity to the alpha (v) beta(3) integrin (a cell-surface marker found to be upregulated in numerous cancers) and the alpha-Gal trisaccharide antigen that interacts with endogenous human antibody. Using out bifunctional conjugate, we found that the multivalent properties of anti-Gal binding can be exploited to triger complement-mediated lysis of only those cells that display elevated levels of alpha (v) beta (3)

integrin. The ability of anti-Gal to cause complement-medicated lysis depends on the concentration of alpha-Gal epitopes displayed on the cell surface.
DTIC
Antibodies; Breast; Cancer; Mammary Glands; Targets

20100018896 Arizona State Univ., Tempe, AZ USA
Self-Assembled Combinatorial Nanoarrays for Multiplex Biosensing
Yan, Hao; Feb 5, 2010; 19 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0080
Report No.(s): AD-A518368; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In 2009, we have studied multivalent DNA hybridization in a nanostructured system. We have used lithographically patterned substrate to direct the assembly of DNA nanoarrays. We have succeeded in in-vivo cloning of DNA nanostructures.
DTIC
Combinatorial Analysis; Deoxyribonucleic Acid; Multiplexing; Nanostructures (Devices)

20100018899 Portland Univ., OR USA
Enhanced Androgen Signaling with Androgen Receptor Overexpression in the Osteoblast Lineage Controls Skeletal Turnover, Matrix Quality and Bone Architecture
Wiren, Kristine M; Dec 2009; 324 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0086
Report No.(s): AD-A518379; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Androgens have been shown to be important mediators of bone growth and remodeling independent of estrogen. We genetically engineered transgenic mice in which androgen receptor (AR) overexpression is skeletally targeted in two separate models to better understand the role of androgen signaling directly in bone. In the fourth year, we have published the analysis of the second line of AR-transgenic mice, AR2.3-transgenic mice. Enhanced androgen signaling directly in bone results in inhibition of bone formation by differentiated osteoblasts, with a phenotype reflecting low turnover. Comparisons between both models of AR2.3- and AR3.6-transgenic animals suggests that AR transactivation in osteocytes is primarily responsible for mediating the effects of androgen on matrix quality and/or mineralization (inhibitory), while stromal/immature cells mediate effects of androgen on the periosteum and body composition (anabolic). The consequence of androgen action in vivo is compartment-specific; anabolic effects are exhibited exclusively at periosteal surfaces, but in mature osteoblasts androgens inhibit osteogenesis with detrimental effects on matrix quality, bone fragility and whole bone strength (Specific Aim 1). Gene expression profiling has identified important signaling pathways by which androgens influence osteoblast-osteoclast communication (Specific aim 2). Ex vivo differentiation analysis of proliferation and differentiation in calvarial cultures from AR3.6-tg and AR2.3-tg mice demonstrates inhibition of proliferation that is not affected by the AR-tg (likely because expression levels are low in proliferating cultures), and robust inhibition of osteoblast matrix maturation and mineralization that is most severe in cultures with AR overexpression throughout the osteoblast lineage (Specific aim 3).
DTIC
Bones; Hormones; Males; Musculoskeletal System; Osteoblasts

20100018911 Army Medical Research and Materiel Command, Fort Detrick, MD USA
FIEFDom: A Transparent Domain Boundary Recognition System using a Fuzzy Mean Operator
Bondugula, Rajkumar; Lee, Michael S; Wallqvist, Anders; Dec 4, 2008; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Protein domain prediction is often the preliminary step in both experimental and computational protein research. Here we present a new method to predict the domain boundaries of a multidomain protein from its amino acid sequence using a fuzzy mean operator. Using the nr-sequence database together with a reference protein set (RPS) containing known domain boundaries, the operator is used to assign a likelihood value for each residue of the query sequence as belonging to a domain boundary. This procedure robustly identifies contiguous boundary regions. For a dataset with a maximum sequence identity of 30%, the average domain prediction accuracy of our method is 97% for one domain proteins and 58% for multidomain proteins. The presented model is capable of using new sequence/ structure information without re-parameterization after each RPS update. When tested on a current database using a four year old RPS and on a database that contains different domain definitions than those used to train the models, our method consistently yielded the same accuracy while two other published

methods did not. A comparison with other domain prediction methods used in the CASP7 competition indicates that our method performs better than existing sequence-based methods.
DTIC
Boundaries; Molecular Structure; Proteins; Transparence

20100018912 Army War Coll., Carlisle Barracks, PA USA
The War on Drugs: A New Strategy
Tilzey, Danny F; Mar 2010; 33 pp.; In English
Report No.(s): AD-A518414; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The term War on Drugs was first used by President Richard M. Nixon in 1969, and since then billions of dollars have been spent and countless lives affected in attempts to end this debatably unsuccessful war on drugs. As such, the USA (U.S.) needs to rethink its current war on drugs by employing a new strategy that reduces the key negative effects of drugs, specifically costs to the taxpayer, death and disease, and crime. This paper discusses: (1) the current U.S. drug control policy, (2) three strategy options with brief arguments for and against each option, and (3) a comparison of each option in relation to reducing the key negative effects of drugs as cited above. Based on the comparisons of each option, a recommendation of a new strategy for the U.S. to employ against drug use and abuse is provided.
DTIC
Law (Jurisprudence); Narcotics; Public Health; Warfare

20100018913 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
CpG Oligodeoxyribonucleotides Protect Mice from Burkholderia Pseudomallei but not Francisella Tularensis Schu S4 Aerosols
Rozak, David A; Gelhaus, Herbert C; Smith, Mark; Zadeh, Mojgan; Huzella, Louis; Waag, David; Adamovicz, Jeffrey J; Jan 2010; 6 pp.; In English
Report No.(s): AD-A518415; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Studies have shown that CpG oligodeoxyribonucleotides (ODN) protect mice from various bacterial pathogens, including Burkholderia pseudomallei and Francisella tularensis live vaccine strain (LVS), when administered before parenteral challenge. Given the potential to develop CpG ODN as a pre-treatment for multiple bacterial biological warfare agents, we examined survival, histopathology, and cytokine data from CpG ODN-treated C57BL/6 mice to determine whether previously-reported protection extended to aerosolized B. pseudomallei 1026b and highly virulent F. tularensis Schu S4 infections. We found that, although CpG ODN protected mice from aerosolized B. pseudomallei challenges, the immunostimulant failed to benefit the animals exposed to F. tularensis Schu S4 aerosols. Our results, which contrast with earlier F. tularensis LVS studies, highlight potential differences in Francisella species pathogenesis and underscore the need to evaluate immunotherapies against human pathogenic species.
DTIC
Aerosols; Mice; Microorganisms; Pathogens

20100018917 Naval Research Lab., Washington, DC USA
Formation of Amine Groups on the Surface of GaN: A Method for Direct Biofunctionalization
Stine, R; Simpkins, B S; Mulvaney, S P; Whitman, L J; Tamanaha, C R; Jan 2010; 6 pp.; In English
Report No.(s): AD-A518430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Gallium nitride has attracted significant interest as a material for biosensors; however, techniques for biofunctionalizing GaN surfaces have received limited attention. Here, we present a method for producing amine groups directly on GaN surfaces through exposure to a glow discharge plasma fed with humidified air, thereby eliminating the need for complex organic functionalization chemistry. Amine formation is tracked via X-ray photoelectron spectroscopy (XPS) by labeling the plasma-formed surface groups with a fluorinated probe that binds specifically to primary amines. These amine groups can subsequently couple covalently to a wide range of biomolecules. The covalent immobilization of a NeutrAvidin layer is demonstrated using Fourier transform infrared spectroscopy (FT-IR) and fluorescent biotin-binding assays. Finally, we show that plasma exposure times sufficient for the formation of amine groups do not significantly alter the conductivity of the GaN substrate.
DTIC
Amines; Biochemistry; Bioinstrumentation; Fourier Transformation; Gallium Nitrides; Infrared Spectroscopy

20100018924 North Shore-Long Island Jewish Research Inst., Manhasset, NY USA
Stimulation of Estrogen Receptor Signaling in Breast Cancer by a Novel Chaperone Gamma Synuclein
Shi, Yuenian; Jun 1, 2009; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0569
Report No.(s): AD-A518447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The present study demonstrated SNCG can partially replace the chaperoning function of Hsp90 and protect HER2/Akt/mTOR stability and function in the stressful condition when the function of Hsp90 is blocked. Disruption of Hsp90 with 17-AAG resulted in a significant degradation of HER2. However, expression of SNCG completely recovered 17-AAG-mediated losses of HER2. This SNCG-mediated protection was demonstrated in breast cancer cells, tumor xenograft, and mammary glands from HER2/SNCG bitransgenic mouse. Consistent with its chaperoning activity, SNCG bound to HER2 in the presence and absence of Hsp90. While expression of SNCG renders resistance to 17-AAG-induced apoptosis both in vitro and in tumor xenograft, knockdown endogenous SNCG enhances the sensitivity to the Hsp90 disruption. Crossing SNCG transgenic mice with HER2 mice stimulated HER2-induced tumor growth and rendered resistance to 17-AAG-mediated antitumor effect on the transgenic mice. The present study indicates that SNCG functions as a tumor specific chaperone, which can replace the chaperoning function of Hsp90, protect its client protein HER2, and render a resistance to Hsp90 disruption.
DTIC
Breast; Cancer; Estrogens; Mammary Glands; Stimulation

20100018934 Naval Research Lab., Monterey, CA USA
By the Light of the Sea
Miller, S D; Haddock, S H; Lee, T F; Elvidge, C D; Jan 2007; 8 pp.; In English
Report No.(s): AD-A518483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

January 25, 1995: On a dark evening in the Arabian Sea off the coast of Somalia, a merchant vessel was steaming southward when its crew began to notice a strange glow in the distance. Within minutes, and for six hours thereafter, the S.S. Lima found herself cutting through waters producing a radiant white glow reminiscent of a boundless snowfield. Ten years later, scientists learning of Lima's surreal encounter sought out the date and time within an archive of low-light satellite data. The match found between the ship' position and an anomalous light source in the satellite data - spanning an area exceeding 15,000 km2 and morphing over several night's time in a way consistent with the known sea surface currents - marked the first confirmed remote-sensing of the legendary milky sea, a poorly understood phenomenon thought to be linked to population explosions of luminous bacteria. Here, we detail the unusual circumstances and important implications of this discovery.
DTIC
Anomalies; Arabian Sea; Bacteria; Bioluminescence; Ocean Surface; Seas

20100018946 Naval Postgraduate School, Monterey, CA USA
An Analysis of First Duty Station Placement and New Graduate Transition Education on Retention in the Navy Nurse Corps
Krause, Kathryn J; Mar 2010; 108 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518528; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis examines the association between initial duty station assignment and retention of Nurse Corps officers. The main hypothesis of the thesis is that due to the increased clinical opportunities, higher patient acuity and larger patient census in major medical centers, Nurse Corps officers receive more education and training prospects, which makes them more clinically prepared with higher job satisfaction. In nursing research, clinical preparedness and job satisfaction are both linked positively with retention. Using qualitative techniques to analyze the professional nursing literature and interview with military and civilian hospital administrators, comparing and contrasting Nurse Intern Programs at three Navy major medical centers, two Navy mid-level hospitals and four civilian facilities, and the quantitative technique of a multivariate model to analyze cohort data for new nurse accessions from 1994-1998, the author compares Nurse Intern Programs and isolates the effect of Military Treatment Facility assignment on retention. The results indicate there is no Navy-wide standardized education program for new nurses, potentially negatively affecting overall medical readiness, and that assignment at a major Military Treatment Facility is not a statistically significant predictor of retention. Further analysis of Nurse Intern programs is necessary to establish the effectiveness of the programs.
DTIC
Education; Medical Personnel; Military Personnel; Navy; Personnel Management

20100018968 Naval Postgraduate School, Monterey, CA USA

Integrating Monetary and Non-Monetary Retention Incentives for the U.S. Navy Dental Corps Officers Utilizing the Combinatorial Retention Auction Mechanism (CRAM)

Cascardo, Neil D; Kumar, Sandeep; Mar 2010; 162 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research focused on the Navy Dental Corps community because of the retention challenges encountered, especially at the senior Lieutenant and Lieutenant Commander Ranks. The Dental Corps has retention goals by accession cohort and specialty mix to support the correct number of specialty trained officers to meet billet requirements in support of Navy and Marine Corps Dental Readiness. The requirement is to retain a healthy number of Dental Officers by specialty and pay grade to meet both clinical needs, and maintain senior leadership capability in the future. This research used the Universal Incentive Package (UIP) auction and Combinatorial Retention Auction Mechanism (CRAM) to identify the cost savings opportunities for the Navy, while retaining the optimal number of Dental Corps officers. Additionally, this research summarized the importance of creating a balance between monetary and non-monetary incentives. The Oracle Crystal Ball Monte Carlo simulation indicated that CRAM outperformed monetary only and universal auction mechanisms with an average savings between 24 and 30 percent. This research concluded that 61 percent retention level could be achieved by offering CRAM with an average savings of 24 percent over monetary only and UIP. The research concludes that CRAM provides an opportunity to individualize benefits that are not only valued by Dental Corps officers, but are also cost effective for the Navy. For the Navy to achieve its retention goals and becoming a top-50 employer, it is imperative to create a balance between monetary and non-monetary incentives. This not only enhances morale but also overcomes workrelated challenges.

DTIC

Clinical Medicine; Combinatorial Analysis; Dentistry; Incentives; Navy; Personnel; Personnel Management

20100018981 Duke Univ., Durham, NC USA

The Role of a Mitochondrial Progesterone Receptor in the Growth of Breast Epithelial Cells

Price, Thomas M; Sep 2009; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0549

Report No.(s): AD-A518622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This proposal proves a new molecular mechanism whereby progesterone via a mitochondrial receptor, named PR-M, influences the growth of breast cancer cells by enhancing cellular respiration. For this purpose we developed an RNAi assay to silence expression of PR-M in T47D breast cancer cells. We have demonstrated with this assay a decrease in PR-M transcript levels by qRT-PCR and a decrease in protein levels with western blot analysis. Functionally, we then demonstrated a decrease in progesterone/progestin induced mitochondrial membrane potential with silencing of PR-M expression. We then sought to determine the influence of PR-M silencing on the metabolomic pathway of these cells. These studies are still ongoing but initially suggest an increase in lipid catabolism with increased levels of acylcarnitines. These results suggest that progesterone increases cellular energy production by influencing fatty acid oxidation via a unique mitochondrial progesterone receptor. This provides a new mechanism whereby progesterone influences the growth and survival of breast cancer cells.

DTIC

Breast; Cancer; Females; Hormones; Mammary Glands; Mitochondria

20100018982 Michigan Univ., Ann Arbor, MI USA

Chemoprevention by Elimination of Cancer-Prone, Mutant p53-Containing Breast Cells

Sun, Yi; Sep 2009; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0539; BC075640; Proj-W91ZSQ8131N632

Report No.(s): AD-A518624; No Copyright; Avail.: Defense Technical Information Center (DTIC)

p53 is regulated at the multiple levels. We report here that p53 in multiple lines of human cancer cells is down-regulated by cardiac glycoside drugs, digoxin or ouabain, the potent inhibitors of Na+/K+-ATPase. These drugs reduced the basal levels of p53 protein at nanomolar concentrations in a dose-, time- and cancer cell line-dependent manner, but independent of p53 status of wild type (wt) or mutant. The drugs also reduced the levels of p53 induced by its activators as well as p53 transfected into human cancer cells, regardless of its status. Interestingly, the drugs had no effect on endogenous p53 in two immortalized human cell lines. Mechanistically, p53 reduction is because reduced protein synthesis. Finally, p53 reduction appears to be triggered by activation of Src/MAPK signaling pathways upon drug binding to the Na+/K+-ATPase and can be completely blocked by the inhibitors of Src or MEK. This is the first report that cardiac glycoside drugs, by initiating the Src/MAPK

signaling pathways, reduce the p53 levels via inhibition of p53 protein synthesis. The drugs may be useful in the treatment of human cancers with a gain-of-function p53 mutation.
DTIC
Breast; Cancer; Mammary Glands

20100018983 Georgetown Univ., Washington, DC USA
Inflammatory Cytokines Induce Ubiquitination and Loss of the Prostate Suppressor Protein NKX3.1
Muhlbradt, Erin E; Oct 2008; 10 pp.; In English
Contract(s)/Grant(s): W81XWH-05-1-0590
Report No.(s): AD-A518629; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inflammation of the prostate is a risk factor for the development of prostate cancer. In the aging prostate, regions of inflammatory atrophy are foci for prostate epithelial cell transformation. Expression of the suppressor protein NKX3.1 is reduced in regions of inflammatory atrophy and in preinvasive prostate cancer. Inflammatory cytokines tumor necrosis factor (TNF)-alpha and interleukin-1B accelerate NKX3.1 protein loss by inducing rapid ubiquitination and proteasomal degradation. The effect of TNF-alpha is mediated via the C-terminal domain of NKX3.1 where phosphorylation of serine 196 is critical for cytokine-induced degradation. Mutation of serine 196 to alanine abrogates phosphorylation at that site and the effect of TNF-alpha on NKX3.1 ubiquitination and protein loss. This is in contrast to control of steady-state NKX3.1 turnover, which is mediated by serine 185. Mutation of serine 185 to alanine increases NKX3.1 protein stability by inhibiting ubiquitination and doubling the protein half-life. A third C-terminal serine at position 195 has a modulating effect on both steady-state protein turnover and on ubiquitination induced by TNF-alpha. Cellular levels of the NKX3.1 tumor suppressor are affected by inflammatory cytokines that target C-terminal serine residues to activate ubiquitination and protein degradation. We suggest that the inhibition of inflammation or effector kinases may be useful approaches to prostate cancer prevention.
DTIC
Losses; Prostate Gland; Proteins; Suppressors

20100018987 Weizmann Inst. of Science, Rehovot, Israel
Molecular Evolution of Human PON to Design Enhanced Catalytic Efficiency for Hydrolysis of Nerve Agents
Tawfik, Dan; Sussman, Joel L; Feb 2010; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-2-0020
Report No.(s): AD-A518633; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term objective of this effort is to develop a generic gene shuffling- based technology to rapidly screen libraries of 1010 proteins/peptides encoded by DNA libraries, for identifying biomolecules that can intercept both existing and emerging organophosphate-based chemical warfare nerve agents (CWNA). All 3rd year milestones have been met, and additional tasks were performed to advance the goals of the project:(1) Plasmids of mutants 8C8, 2H4, and 1G3 were delivered for further evaluation against authentic nerve agents at USAMRICD. In addition, on early March 2009, 9 mutants were expressed and purified in our laboratory and transferred to USAMRICD. (2) Two mutants which displayed enhanced hydrolysis properties were over expressed, crystallized, and their 3D structure revealed movements of the catalytic Ca2+ and amino acid side chains coordinating to the catalytic calcium. (3)In vitro and in vivo studies demonstrated improved thermostability and antidotal efficacy of wt rePON1 compared to human PON1. (4) Stereo-specific protocols were developed for the synthesis of enantiomers of coumarin surrogates of nerve agents (5) A Protocol was developed for a safe in situ procedure for fluoridation of coumarin analogs of nerve agents thus permitting direct selection of clones by use of G-agents and the interception technique. This technology is envisaged to provide rapid discovery of pretreatment and post challenge therapeutic drugs against existing & emerging CWNA threats and will shorten the time from emergence of a threat to identification of potential counter-measures to a few days or weeks.
DTIC
Chemical Warfare; Drugs; Hydrolysis; Nerves; Organic Phosphorus Compounds; Therapy

20100019020 Sitek Research Labs., Rockville, MD USA
Evaluation of a Test Article in the L5178Y TK+/-Mouse Lymphoma Mutagenesis Assay with Colony Size Evaluation in the Presence and Absence of Induced Rat Liver S-9 with a Confirmatory Study. Test Article: 3-Nitro-1,2,4-Triazol-5-one (NTO)
Kirby, Paul E; Nov 17, 2008; 78 pp.; In English
Contract(s)/Grant(s): W91ZLK-07-P-1646
Report No.(s): AD-A518708; SITEK-0985-2400; No Copyright; Avail.: Defense Technical Information Center (DTIC)

3-Nitro-1,2,4-triazol-5-one (NTO, 99.6% pure) was tested for its potentials to induce mutation at the thymidine kinase

locus of L5178Y TK +/- mouse lymphoma cells in vitro with and without metabolic activation according to OECD TG 476 in compliance with Good Laboratory Practice. Cell cultures were treated with NTO at concentrations of 10, 50, 100, 250, 500, 1000, 2500, and 5000 with and without activation and were found negative in the mutation assay. A confirmatory mutation assay with 24 hrs treatment period and without activation was performed by using the same concentrations of NTO. These results were also negative.
DTIC
Assaying; Colonies; Liver; Mice; Mutagenesis; Mutagens; Mutations; Rats; Tumors

20100019028 Stanford Univ., Stanford, CA USA
Hybrid Multiscale Landmark and Deformable Image Registration
Paquin, Dana; Levy, Doron; Xing, Lei; Apr 11, 2007; 28 pp.; In English
Contract(s)/Grant(s): PC040282; DMS-0133511
Report No.(s): AD-A518734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An image registration technique is presented for the registration of medical images using a hybrid combination of coarse-scale landmark and B-splines deformable registration techniques. The technique is particularly effective for registration problems in which the images to be registered contain large localized deformations. A brief overview of landmark and deformable registration techniques is presented. The hierarchical multiscale image decomposition of E. Tadmor, S. Nezzar, and L. Vese, A multiscale image representation using hierarchical (BV;L2) decompositions, Multiscale Modeling and Simulations, vol. 2, no. 4, pp. 554{579, 2004, is reviewed, and an image registration algorithm is developed based on combining the multiscale decomposition with landmark and deformable techniques. Successful registration of medical images is achieved by first obtaining a hierarchical multiscale decomposition of the images and then using landmark-based registration to register the resulting coarse scales. Corresponding bony structure landmarks are easily identified in the coarse scales, which contain only the large shapes and main features of the image. This registration is then fine tuned by using the resulting transformation as the starting point to deformably register the original images with each other using an iterated multiscale B-splines deformable registration technique. The accuracy and efficiency of the hybrid technique is demonstrated with several image registration case studies in two and three dimensions. Additionally, the hybrid technique is shown to be very robust with respect to the location of landmarks and presence of noise.
DTIC
Clinical Medicine; Deformation; Image Processing; Landmarks; Pattern Registration

20100019210 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Economic Feasibility of Installing an Anaerobic Digester on a Department of Defense Installation
Strange, Russell A.; Mar. 2010; 72 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518691; AFIT/GES/ENV/10-M05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Improving technology has made anaerobic digestion a viable method for disposing of organic waste and creating alternative energy. The purpose of this research was to examine the feasibility of installing an anaerobic digester on a Department of Defense installation, and measure its contribution to the execution of Executive Order 13423. A present worth equation was derived in accordance with 10 Code of Federal Regulations 436 expressing viable costs and benefits of an anaerobic digester. A case study of Wright Patterson Air Force Base (WPAFB) was then presented using the derived equation and operational data from functional digesters in the Ohio area. The research identified that an anaerobic digester at WPAFB is not financially practical at this time, but would contribute towards the goals of Executive Order 13423. The derived cost-analysis equation can be applied to any U.S. military base.
DTIC
Activity (Biology); Anaerobes; Bacteria; Bioconversion; Cost Effectiveness; Defense Program; Economic Analysis; Economics; Installing

20100019353 Applied Research Associates, Inc., Tyndall AFB, FL USA
Consistency and Reproducibility of Bioaerosol Delivery for Infectivity Studies on Mice
Stone, Brenton R; Mar. 2010; 92 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA4819-07-D-0001; Proj-DODT
Report No.(s): AD-A518394; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Questions about the clinical significance of an antimicrobial resin use don personal respirators led system to generate

consistent test bioaerosols for use in animal studies. The hypothesis was proposed that an aerosol delivery system based on the Collision nebulizer can be designed and engineered to provide, at selectable concentrations, a respiratory challenge of bioaerosol particles that is verifiably consistent in time and that can be fed in separate experiments through treated and untreated filters to deliver a consistent challenge to a small-animal model of human respiration. To verify this hypothesis, such an experimental filtration system was designed and built. Challenge trials were performed with MS2 bacteriophage and Bacillus atrophaeus. Over 30 to 40 minutes, the particle size distribution (PSD) was measured, and viability of microorganisms collected in All-Glass Impingers (AGI-4s) was determined. Concentrations of particles and microorganisms downstream of the filter were too low to measure, and the viable counts for MS2 bacteriophage were not measured at all owing to problems with the assay method. However, in each experiment, the coefficients of variations (CVs) of time-series measurements of the total particle count, count median diameter, and geometric experiments with viability data, all CVs of time-series measurements of upstream viable airborne concentration were less than 26%. This CV is somewhat higher than has been reported in the literature for tests with airborne Bacillus spores, but the plating method used to measure the viability may have introduced additional variation that was not caused within the system itself. It can be reasoned based on this data that the system can provide a sufficiently steady aerosol challenge to be used for later studies using a small-animal model of human respiration. The system provides a design for an animal exposure system incorporating aerosol filtration, which is a capability previously unreported.
DTIC
Aerosols; Bacteriophages; Consistency; Mice; Respiratory Diseases; Variational Principles

20100019430 Sitek Research Labs., Rockville, MD USA
In Vivo Test for Chemical Induction of Micronucleated Polychromatic Erythrocytes for Mouse Bone Marrow Cells, Test Article, Diethylene Triamine Trinitrate (DETN)
Shore, Karen S.; Kirby, Paul E.; February 25, 2010; 64 pp.; In English
Contract(s)/Grant(s): W91ZLK-09-P-0958
Report No.(s): AD-A518023; 1001-1521; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518023

Diethylene triamine trinitrate (DETN) (100%) pure) was tested for its potentials to induce micronucleated polychromatic erythrocytes (MPCE) in the bone marrow cells of male and female CD-1 mice according to OECD TG 474 in compliance with Good Laboratory Practice. Male and female mice were dosed orally at 500, 1000, and 2000 mg;/kg. Animals were euthanized approximately 24 and 48 hr after dosing. The percent of polychromatic erythrocytes (PCE) and frequency of micronucleated polychromatic erythrocyte (MPCE) were determined at 24 and 48 hrs. Cytotoxicity was assessed by scoring the number of PCE and norchromatic erythrocyte (NCE) in first 200 erythrocytes for each animal. There were no statistically significant increases in the number of MPCE in the treated groups when compared to the concurrent vehicle control group. These results indicated that DETN was negative in vivo mouse micronucleus assay.
DTIC
Bone Marrow; Cells (Biology); Erythrocytes; Ethers; Evaluation; In Vivo Methods and Tests; Mice; System Effectiveness

20100019431 Sitek Research Labs., Rockville, MD USA
Test for Chemical Induction of Chromosome Aberrations in Cultured Chinese Hamster (CHO) Cells With and Without Metabolic Activation. Test Article. Diethylene triamine trinitrate (DETN)
Song, Jian; Kirby, Paul E.; Feb. 25, 2010; 65 pp.; In English
Contract(s)/Grant(s): W91ZLK-09-P-0958
Report No.(s): AD-A518018; 1001-3110; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518018

Diethylene triamine trinitrate (DETN) (100% pure) was tested for its potential to induce chromosome aberrations in cultured Chinese Hamster Ovary (CHO) cells with and without metabolic activiation according to OECD TG 473 in compliance with Good Laboratory Practice. DETN was found negative at concentrations 100, 500, 100, 2500, and 5000 ug/mL in both with and without activation. A confirmatory chromosome aberration assay was performed without activation also showed negative.
DTIC
Cells (Biology); China; Chromosome Aberrations; Chromosomes; Ethers; Hamsters; Metabolism; Ovaries

20100019456 Sitek Research Labs., Rockville, MD USA

Test for Chemical Induction of Chromosome Aberrations in Cultured Chinese Hamster (CHO) Cells With and Without Metabolic Activation, Test Acticle: Ethylenediamine Dinitrate (EDDN)

Song, Jian; Kirby, Paul E.; Feb. 25, 2010; 65 pp.; In English

Contract(s)/Grant(s): W91ZLK-09-P-0958

Report No.(s): AD-A518238; 1003-3110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518238

Ethylenediamine dinitrate (EDDN) (99.5% pure) was tested for clastogenic potential to induce chromosome aberrations in cultured Chinese Hamster Ovary (CHO) cells with and without metabolic activation according to OECD TG 473 in compliance with Good Laboratory Practice,. EDDN was tested at concentrations 500, 1000, 2000, 3000, 4000 and 5000 ug/mL both with and without activation. Based on the cytotoxicity data, chromosome aberrations were scored from the cells treated with the concentrations 1000, 2000, and 3000 ug/mL without activation and 3000, 4000, and 5000 ug/mL with activation. Two hundred metaphases were scored from each concentration and controls. EDDN did not induce a statistically significant increase in the percentage of chromosome aberration, polyploidy and endoreduplicated cells in the CHO cells both with and without activation. A confirmatory chromosome aberration assay was performed without activation also showed negative.

DTIC

Cells (Biology); China; Chromosome Aberrations; Chromosomes; Dinitrates; Ethers; Ethylenediamine; Hamsters; Metabolism; Ovaries

20100019462 Sitek Research Labs., Rockville, MD USA

Evaluation of a Test Article in the Salmonella typhimurium/Ecscherichia coli Plate Incorporation Mutation Assay in the Presence and Absence of Induced Rat Liver S-9. Test Article - Diethylene triamine trinitrate (DETN)

Song, Jian; Kirby, Paul E.; February 25, 2010; 72 pp.; In English

Contract(s)/Grant(s): W91ZLK-09-P-0958

Report No.(s): AD-A517996; 1001-2140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517996

Diethylene triamine trinitrate (DETN) (100% pure) was tested for mutagenic potentials with Salmonella typhimurium strains, TA 98, TA 100, TA 1535, TA 1537 and Escherichia coli strain WP2 uvrA by plate incorporation method according to OECD TG 471 in compliance with Good Laboratory Practice. The results showed that DETN was not mutagenic in Salmonella typhimurium and Escherichia coli both with and without activation at concentration of 100, 500, 1000, 3000, and 5000 ug/plate with and without activation.

DTIC

Assaying; Escherichia; Ethers; Histidine; Liver; Mutations; Rats; Salmonella

20100019510 NASA Johnson Space Center, Houston, TX, USA

Effects of Changing Center of Gravity on Shirt-Sleeve Human Performance in Reduced Gravity

Norcross, Jason R.; Clowers, Kurt G.; Clark, Tim; Cowley, Matthew S.; Harvill, Lauren; Chappell, Steven P.; Stroud, Leah C.; Desantis, Lena; Paloski, William H.; Morecny, Richard M.; Vos, Jessica R.; Gernhardt, Michael L.; April 2010; 148 pp.; In English; Original contains color and black and white illustrations

Report No.(s): JSC-CN-20630; Copyright; Avail.: CASI: A07, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019510

The primary objective of this study was to evaluate if and how a change in system CG affects human performance metrics (eg, metabolic rate, biomechanics, subjective ratings, stability) in simulated lunar gravity during level ground ambulation, inclined ambulation, exploration tasks and postural testing. It should be noted that this objective was to be tested in both the unsuited and suited condition, but was only tested in the unsuited condition. The PoGO, in its current configuration, could not offload the additional weight required to complete the test in the suited condition (with the MK III suit system as described in the IST-1 final report (1) and the new CG rig); therefore, the planned objectives for the suited condition were deleted from this test.

Author

Human Performance; Center of Gravity; Gravitational Effects; Biodynamics; Metabolism; Stability; Posture; Microgravity; Lunar Gravitation

20100019632 Virginia Univ., Charlottesville, VA USA

Role of STAT5b in Breast Cancer Progression and Metastasis

Bernaciak, Teresa M; Sep 2009; 151 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0738

Report No.(s): AD-A518779; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518779

Signal transducer and activator of transcription 5b (STAT5b) is a transcription factor which promotes growth and survival of a number of cancers, including breast cancer. The objective of this work was to elucidate the role of STAT5b in breast cancer cell migration. Through siRNA knockdown technology, the necessity of STAT5b for migration of two highly aggressive, highly migratory, breast cancer cell lines (BT-549 and MDA-MB-231), was explored. Knockdown of STAT5b inhibited migration of both cell lines by 60-80%. More specifically, STAT5b knockdown suppressed migration of these cells to the extracellular matrix component fibronectin, suggesting that STAT5b is an important signaling component in beta1 integrin-mediated migration of breast cancer cells. Inhibition of migration upon STAT5b knockdown was rescued by wild-type STAT5b as well as transcriptionally inactive Y699F- and dominant-negative forms of STAT5b. In contrast, an SH2 domain defective R618K-STAT5b did not rescue migration. These data indicate that STAT5b-mediated transcription is not required for promoting migration, but SH2 domain interactions are necessary. Upon spreading, STAT5b knockdown cells adopted a striking phenotype characterized by the formation of multiple, highly contractile protrusions. In accordance with these findings, knockdown cells exhibited high levels of myosin light chain phosphorylation, independent of attachment. Additionally, knockdown of STAT5b correlated with loss of polarity, resulting in lack of directionality during wound closure. In summary, the data presented here identifies a novel, SH2- dependent function of STAT5b in regulating beta1 integrin-mediated migration of highly aggressive

DTIC

Breast; Cancer; Mammary Glands; Metastasis

20100019635 British Columbia Cancer Agency, Vancouver, British Columbia Canada

Characterization of Human Mammary Epithelial Stem Cells

Eirew, Peter; Oct 2009; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0702

Report No.(s): AD-A518797; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518797

The mammary epithelium of normal adult female mice contains stem cells with extensive in vivo regenerative and self-renewal potential. Indirect evidence has suggested that analogous cells exist in the mammary glands of adult women, and are candidate targets for the first transforming mutations that lead to the evolution of breast cancer stem cells. The objective of this grant was to determine whether these hypothesized normal human mammary stem cells might be detected and quantified by a robust and specific assay that could be used to enable the purification and phenotypic properties of these cells, and to derive information about their frequency and how they are regulated. During the 3 years of this grant, I established conditions that allow human mammary gland structures to be reproducibly generated in subrenal xenografts in highly immune deficient mice, starting with small innocula of dissociated human mammary cells. The regenerated glands are similar in morphology and cellular organization to normal human mammary glands, bounded by a basement membrane with an outer layer of myo-epithelial cells and an inner layer of polarized luminal cells that can be induced to produce milk. I also established that the presence of regenerated structures can be determined by detecting the in vitro clonogenic progenitors they contain and this endpoint can serve as an objective indicator of the presence of a primitive stem-like cell in the initial cells transplanted. This retrospective functional assay allows limiting dilution analysis of positive xenograft yields to derive mammary stem cell frequencies in differently manipulated populations. Using this approach I found the frequency of stem cells in normal human mammary tissue to be 1 per 5000 cells and their phenotype to be CD49f+ EpCAM-/low CD31- CD45-.

DTIC

Mammary Glands; Stem Cells

20100019639 Sitek Research Labs., Rockville, MD USA

Test for Chemical Induction of Chromosome Aberrations in Cultured Chinese Hamster Ovary (CHO) Cells with and without Metabolic Activation, Test Article: 3-Nitro-1,2,4-Triazol-5-one (NTO)

Song, Jian; Oct 30, 2008; 69 pp.; In English

Contract(s)/Grant(s): W91ZLK-07-P-1646

Report No.(s): AD-A518834; SITEK-0985-3110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518834

3-Nitro-1,2,4-triazol-5-one (NTO, 99.6% pure) was tested for its potentials to induce chromosome aberrations in cultured Chinese Hamster Ovary (CHO) cells with and without metabolic activation according to OECD TG 473 in compliance with Good Laboratory Practice. NTO was found negative at concentrations of 5, 50, 100, 500, 1000, 2500, and 5000 g/mL in both with and without activation. A confirmatory chromosome aberration assay was performed without activation also showed negative.

DTIC

Activation; China; Chromosome Aberrations; Chromosomes; Hamsters; Intake Systems; Metabolism; Ovaries

20100019643 Michigan Univ., Ann Arbor, MI USA

PTSD Trajectory, Comorbidity, and Utilization of Mental Health Services Among Reserves

Galea, Sandro; Oct 2009; 98 pp.; In English

Contract(s)/Grant(s): W81XWH-08-2-0204

Report No.(s): AD-A518840; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518840

This research will assess mental health and mental health service utilization over time among a representative sample of Reserve forces, within a multivariate causal framework taking into account life course experiences together with combat history, other military experience and civilian traumatic event experiences as determinants of mental health. We focus on the prevalence and correlates of PTSD and other mental illness and health service utilization, but also on the trajectories of PTSD and co-occurring psychopathology over time. The scope includes developing, piloting and implementing a structured survey for a random sample of Reserve members. Findings from analyses of all three waves of the survey will be disseminated to key stakeholders. To date, we have constructed a survey that contains modules on (1) risk or protective factors for psychological morbidity over the life course (general traumas, psychological resources, life and family concerns), (2) mental health (depression, PTSD, emotional health history), (3) service utilization patterns (use of mental health resources). Additionally, we have developed the infrastructure for high volume contact, interviewing and tracking of eligible Reserves. Further, we have just received clearance for contact information on eligible Reserves, making contact and survey piloting imminent.

DTIC

Medical Services; Mental Health; Military Operations; Reserves; Trajectories

20100019656 Woods Hole Oceanographic Inst., MA USA

The Influence of Iron on the Cellular Quota of Prochlorococcus

Saito, Mak; Jan 2008; 16 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0704

Report No.(s): AD-A518869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518869

This project studied the influence of iron nutrition on the physiology and molecular ecology of marine cyanobacteria and their resultant effects on seawater optical properties. The influence of iron on marine primary production is now known to rival that of nitrogen. Given iron's integral part of photosynthetic metalloproteins, this element can have a strong effect on the pigmentation of phytoplankton. The marine cyanobacteria, including Prochlorococococcus marinus and marine Synechococcus, are among the most abundant phytoplankton in the oceans, and hence contribute significantly to both carbon cycling and ocean optical properties. Through this Office of Naval Research Young Investigator Award (ONR-YIP), our laboratory has studied the iron requirements of these marine cyanobacteria and their physiological, optical and molecular characteristics. Because Prochlorococcus is relatively difficult to grow and pure cultures were only recently produced (Saito et al., 2002), studies of the elemental composition and requirements of this key phytoplankton species have not been possible until recently. Yet, global ecosystem models have been lacking necessary iron growth parameters for this key phytoplankton group that are

needed to improve the predictive capability of marine primary productivity and the seawater optical properties.
DTIC
Bacteria; Iron; Phytoplankton; Sea Water

20100019660 Stanford Univ., Stanford, CA USA
Vitamin D, Breast Cancer and Bone Health
Balint, Eva; Oct 14, 2009; 7 pp.; In English
Contract(s)/Grant(s): W81XWH-07-1-0694; BC063523
Report No.(s): AD-A518878; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518878

This is a multidisciplinary postdoctoral award investigating the role of vitamin D in aromatase inhibitor-induced osteoporosis in breast cancer, supporting studies in basic science, clinical research and epidemiology. During the reporting period, the recipient made significant progress in opening the clinical trial and progressing towards obtaining the MS degree in clinical epidemiology. The clinical trial received all necessary approvals including the IND from the FDA, and approvals from the IRB's from both at Stanford University and the DoD, and the trial is ongoing and recruiting participants. The recipient is scheduled to graduate in the Fall quarter 2009, and is currently working on the master's thesis on the role of vitamin D in breast cancer in general, with a special focus on aromatase inhibitor-induced bone loss. For the animal studies, the recipient obtained all necessary approvals for the experiments (Stanford University and DoD), and the studies will be performed during the third year.
DTIC
Bones; Breast; Calciferol; Cancer; Health; Mammary Glands

20100019661 Utah Univ., Salt Lake City, UT USA
Cerebrovascular Injury in Blast Loading
Monson, Kenneth L; Jan 2010; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0295
Report No.(s): AD-A518880; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518880

The central hypothesis of this project is that the function of the cerebral vasculature is impaired in response to primary blast loading. A shock tube is being utilized to study overpressure alteration of cerebral blood flow and disruption of the blood-brain barrier in the living rat, along with change of passive and active response of isolated rat cerebral vessels. Key accomplishments during the first year of this award include construction of a shock tube, development of a computational model to simulate blast production using a shock tube, and modification of a vessel testing system to accommodate rat cerebral vessels and to allow fluid circulation with temperature and pH control.
DTIC
Blast Loads; Brain; Brain Circulation; Cerebrum; Injuries

20100019662 Emory Univ., Atlanta, GA USA
Progesterone in the Field-Forward Treatment of Traumatic Brain Injury
Stein, Donald G; Nov 1, 2009; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0184
Report No.(s): AD-A518881; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518881

The purpose of this pre-clinical concept award project was to develop a safe and effective field-forward treatment to reduce neuronal loss after traumatic brain injury and thereby to enhance cognitive, sensory and motor recovery. Our primary objective was to synthesize and screen new progesterone pro-drug candidates for relative solubility that are more potent, stable and easily administered by immediate corporal injection than natural progesterone under battlefield conditions. We also sought to determine whether the prodrug would be as effective as progesterone in promoting neuroprotection after TBI. These objectives were accomplished.
DTIC
Brain; Brain Damage; Females; Hormones

20100019663 Health Research, Inc., Buffalo, NY USA
Oxidative Stress, DNA Repair and Prostate Cancer Risk
Zhao, Hua; Aug 2009; 5 pp.; In English
Contract(s)/Grant(s): W81XWH-08-1-0416
Report No.(s): AD-A518882; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518882

Oxidative stress, which results from an imbalance between ROS and antioxidant capacities, can cause a wide range of direct or indirect DNA damage. There are extensive DNA repair systems that can correct DNA damage caused by ROS before cell replication and mutation fixation. Although oxidative stress appears to be important in the etiology of prostate cancer, so far there is no study to comprehensively investigate the association between DRC of oxidative DNA damage as a phenotype and prostate cancer risk. We hypothesize that DRC of oxidative DNA damage as a phenotype may modify prostate cancer risk. So far, the study has recruited 156 cases and 132 controls. The proposed molecular analysis has begun for all three specific aims.
DTIC
Cancer; Deoxyribonucleic Acid; Prostate Gland; Risk

20100019664 Jackson (Henry M.) Foundation, Rockville, MD USA
Automated Neuropsychological Assessment Metrics Version 4 (ANAM4): Examination of Select Psychometric Properties and Administration Procedures
Proctor, Susan P; Heaton, Kristin J; Dec 2009; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0021
Report No.(s): AD-A518883; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518883

The ability to accurately and efficiently monitor the neurocognitive status of US warfighters under diverse operational and experimental conditions is of critical importance to the ongoing mission and network-centered initiatives of the USA military. The Automated Neuropsychological Assessment Metrics (ANAM) is a computer assisted tool for evaluating neurocognitive performance with demonstrated effectiveness for application in diverse military operational and research testing scenarios. The primary objective of this project is to examine select psychometric and administration properties of the newly-released ANAM4. Four studies are proposed that will: (1) examine common use practices and determine the effect of specific administration procedures on ANAM4 performance, (2) assess the test-retest reliability of individual ANAM4 tests, (3) examine the validity of the ANAM4 mood scale, and (4) develop a representative military normative dataset. The data collection for Study 1 is complete and nearing completion for Studies, 2&3, with data analyses in progress. Study 4 is in the planning phase.
DTIC
Neurology; Psychology; Psychometrics

20100019665 Pennsylvania Univ., Philadelphia, PA USA
Small Molecule Inhibitors of EGFR Ectodomain for Breast Cancer Therapy
Berezov, Alan; Aug 2009; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0256
Report No.(s): AD-A518889; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518889

During the reported period, the designed EGFR ectodomain inhibitor has been tested for inhibition of EGFR phosphorylation and growth of breast cancer cells in vitro and in vivo. The compound has been shown to inhibit EGF induced phosphorylation of EGFR in EGFR over expressing NE91 cells. Strong inhibitory effect of the compound against MDA-MB-468 cells has been demonstrated in a poly-HEMA assay. The compound effectively inhibited tumor growth in mice with MDA-MB-468 xenografts and had a moderate effect in MDA-MB-231 xenografts in vivo. Crystallization studies have produced two types of EGFR crystals suitable for soaking experiments with the inhibitory compounds. A number of structural analogs have been designed and are currently being tested for receptor binding and biological activity.
DTIC
Breast; Cancer; Epidemiology; Inhibitors; Mammary Glands; Molecules; Therapy

20100019668 Library of Congress, Washington, DC USA

TRICARE and VA Health Care: Impact of the Patient Protection and Affordable Care Act (P.L. 111-148)

Panangala, Sidath V; Jansen, Don J; Apr 22, 2010; 12 pp.; In English

Report No.(s): AD-A518914; CRS-R41198; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518914

The 111th Congress recently passed, and the President signed into law, the Patient Protection and Affordable Care Act (P.L. 111-148; PPACA), as amended by the Health Care and Education Reconciliation Act of 2010 (P.L. 111-152; HCERA). In general, PPACA did not make any significant changes to the Department of Defense (DOD) TRICARE program or to the Department of Veterans Affairs (VA) health care system. However, many have sought clarification as to whether certain provisions in PPACA, such as a mandate for most individuals to have health insurance, or extending dependant coverage up to age 26, would apply to TRICARE and VA health care beneficiaries. To address some of these concerns, Congress has introduced and/or enacted legislation. The TRICARE Affirmation Act (H.R. 4887), passed by both the House and the Senate and received by the President, would affirm that TRICARE satisfies the minimum acceptable coverage requirement in PPACA. Similarly S. 3162 (passed by the Senate on March 26, 2010) and H.R. 5014 (introduced in the House on April 14, 2010) would, if enacted, clarify that the Civilian Health and Medical Program of the Department of Veterans Affairs (CHAMPVA), Spina Bifida Health Care Program, and the Children of Women Vietnam Veterans Health Care Program meet the minimum essential coverage requirement under PPACA. In addition, the TRICARE Dependent Coverage Extension Act (H.R. 4923; S. 3201), if enacted, would extend certain PPACA provisions to TRICARE beneficiaries. This report addresses key questions concerning how PPACA will likely affect TRICARE and VA health care. This report will be updated if events warrant.

DTIC

Health; Insurance (Contracts); Medical Services; Patients; Protection

20100019669 Texas A&M Univ., College Station, TX USA

Novel Targeting Approach for Breast Cancer Gene Therapy

Palakurthi, Srinath; Sep 30, 2009; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0559

Report No.(s): AD-A518928; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518928

Poly(amidoamine) (PAMAM) dendrimers of 3.5 generation were first activated with N-hydroxysuccinimide (NHS) to obtain a stable PAMAM-NHS. This NHS activated PAMAM was then coupled with SV119 using 1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide (EDC) coupling. Structural analysis of the conjugate was performed using Bruker 300MHZ 1H NMR spectrometer. PAMAM-NHS-SV119 was fluorescently labeled using FITC (Fluorescein isothiocyanate) and 1.2 molecules of FITC were found conjugated to one molecule of PAMAM. Dendriplexes were prepared with sigma receptor ligand-conjugated PAMAM dendrimers and p53-GFP plasmid. Dendriplex stability was assessed by agarose gel electrophoresis and preliminary experiments were performed to determine the transfection efficiency of these dendriplexes in MCF-7 cells and NCI/RES-ADR cells. To construct a therapeutic plasmid (p53) containing the heparanase promoter, PCR amplification of the heparanase promoter sequences was performed and the experiments to insert p53-heparanase fusion gene into the multiple cloning site of the GFP vector are in progress.

DTIC

Breast; Cancer; Gene Therapy; Mammary Glands

20100019682

Examining Smoking-Induced Differential Gene Expression Changes in Buccal Mucosa

Kupfer, Doris M; White, Vicky L; Jenkins, Marita C; Burian, Dennis; Jan 2010; 27 pp.; In English

Report No.(s): AD-A518964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518964

Gene expression changes resulting from conditions such as disease, environmental stimuli, and drug use can be monitored in the blood. However, a less invasive method of sample collection is of interest because of the discomfort and specialized personnel necessary for blood sampling, especially if multiple samples are being collected. Buccal mucosa (cheek swabs) are easily collected and may be an alternative sample material for biomarker testing. A limited number of studies, primarily in the smoker/oral cancer literature, address this tissue's efficacy as an RNA source for expression analysis. The current study was undertaken to determine if total RNA isolated from buccal mucosa could be used as an alternative tissue source to assay relative gene expression. In this study, qPCR and microarray analyses were used to evaluate gene expression in buccal cells. Initially, qPCR was used to assess relative transcript levels of four genes from whole blood and buccal cells collected from

the same seven individuals at the same time. The RNA isolated from buccal cells was degraded but was of sufficient quality to be used with RT-qPCR to detect expression of specific genes. Second, buccal cell RNA was used for microarray-based differential gene expression studies by comparing gene expression between smokers and nonsmokers. An amplification protocol allowed use of 150-fold less buccal cell RNA than had been reported previously with human microarrays. We report here the finding of a small number of statistically significant differentially expressed genes between smokers and nonsmokers, using buccal cells as starting material. Gene Set Enrichment Analysis confirmed that these genes had a similar expression pattern as results from another study. Our results suggest that despite a high degree of degradation, RNA from buccal cells from cheek mucosa could be used to detect differential gene expression between smokers and nonsmokers.
DTIC
Gene Expression; Smoke; Tobacco

20100019689 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Characterization of a Head-Only Aerosol Exposure System for Nonhuman Primates
Dabisch, P A; Kline, J; Lewis, C; Yeager, J; Pitt, M L; Jan 2010; 11 pp.; In English
Report No.(s): AD-A518982; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518982

A well-characterized exposure chamber is necessary to generate reproducible atmospheres for inhalation toxicology studies. The aim of the present study was to characterize a head-only exposure chamber for non-human primates. Aerosols containing bovine serum albumin (BSA) were used to characterize a 16-L dynamic airflow head-only exposure chamber. A 2S0-ml plastic bottle with a respirator attached located inside the chamber was used to simulate a breathing head. Chamber leak rate, mixing, and aerosol spatial distributions were quantified. The chamber concentration profile was measured at the chamber exhaust using an aerodynamic particle sizer. Aerosol spatial distribution was determined by collecting filter samples at several chamber locations. The particle size distribution was determined by collecting cascade impactor samples at several chamber locations. The estimated chamber leak rate was within standards suggested in the literature. The measured average aerosol residence time was similar to theoretical aerosol residence time, suggesting that the chamber was mixing well. Additionally, the average concentration measured at each of the sampling locations within the chamber was similar, and the within-run coefficients of variation (CV) across all sampling locations was similar to those reported in previously published studies, again suggesting that the aerosol concentration throughout the chamber was uniform. The particle size distribution was similar throughout the exposure chamber. Additionally, the BSA concentration and particle size distributions measured in the breathing zone of the simulated head were not significantly different from measurements made elsewhere in the chamber, suggesting that respiration does not affect the average aerosol concentration or particle size distribution at the mouth.
DTIC
Aerosols; Albumins; Exposure; Primates; Serums; Toxicology

20100019694 Massachusetts Univ., North Dartmouth, MA USA
Host Response to Botulinum Neurotoxins for Developing Diagnostics and Antidotes
Singh, Bal R; Sep 18, 2009; 66 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0095
Report No.(s): AD-A518990; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518990

The goals of the project are to investigate host-response to the exposure of botulinum neurotoxin (BoNT) and its neurotoxin associated proteins (NAPs) by examining immunological effects of different components of BoNT complex, using in vitro lymphocytic cell cultures as well as an animal model so that we can understand, both the immune response as well as characterize damage to the immune system of botulism patients, by identifying the most critical components of BoNT/A complex involved in the binding to the intestinal wall for the translocation across its mucosal layer, and to identify and isolate a protein receptor(s) for BoNT/A or its NAPs, and examine its binding and involvement in the transcytosis/penetration process. The immune response and other cellular responses are targeted for presymptomatic diagnostics, whereas identification of the protein receptor(s) of BoNT or NAPs and also critical components NAPs in the binding and translocation of the BoNT would provide target for the development of antidotes against botulism. The project started in May 2006, and we have just begun to prepare reagents and collect preliminary data. Since BoNT is highly regulated agent, and this project involves close collaboration with Drs. Frank Lebeda, Martha Hale, and Harry Hines of USAMRIID, we have produced two recombinant proteins - a mutant BoNT/A that lacks the endopeptidase activity, and the hemagglutinin 33 (Hn-33), the most abundant

component of NAPs. In accordance with a new hypothesis proposed from our group in 2005, we demonstrated
DTIC
Antidotes; Clostridium Botulinum; Diagnosis; Neuromuscular Transmission

20100019700 Naval Health Research Center, San Diego, CA USA
Single Assay for Simultaneous Detection and Differential Identification of Human and Avian Influenza Virus Types, Subtypes, and Emergent Variants
Metzgar, David; Myers, Christopher A; Russell, Kevin L; Faix, Dennis; Blair, Patrick J; Brown, Jason; Vo, Scott; Swayne, David E; Thomas, Colleen; Stenger, David A; Lin, Baochuan; Malanoski, Anthony P; Wang, Zheng; Blaney, Kate M; Long, Nina C; Schnur, Joel M; Saad, Magdi D; Borsuk, Lisa A; Lichanska, Agnieszka M; Lorence, Matthew C; Feb 2010; 19 pp.; In English
Contract(s)/Grant(s): NCRADA-NRL-06-406
Report No.(s): AD-A519002; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519002

For more than four decades the cause of most type A influenza virus infections of humans has been attributed to only two viral subtypes, A/H1N1 or A/H3N2. In contrast, avian and other vertebrate species are a reservoir of type A influenza virus genome diversity, hosting strains representing at least 120 of 144 combinations of 16 viral hemagglutinin and 9 viral neuraminidase subtypes. Viral genome segment reassortments and mutations emerging within this reservoir may spawn new influenza virus strains as imminent epidemic or pandemic threats to human health and poultry production. Traditional methods to detect and differentiate influenza virus subtypes are either time-consuming and labor-intensive (culture-based) or remarkably insensitive (antibody-based). Molecular diagnostic assays based upon reverse transcriptase-polymerase chain reaction (RT-PCR) have short assay cycle time, and high analytical sensitivity and specificity. However, none of these diagnostic tests determine viral gene nucleotide sequences to distinguish strains and variants of a detected pathogen from one specimen to the next. Decision-quality, strain- and variant-specific pathogen gene sequence information may be critical for public health, infection control, surveillance, epidemiology, or medical/veterinary treatment planning. The Resequencing Pathogen Microarray (RPM-Flu) is a robust, highly multiplexed and target gene sequencing-based alternative to both traditional culture- or biomarker-based diagnostic tests. RPM-Flu is a single, simultaneous differential diagnostic assay for all subtype combinations of type A influenza viruses and for 30 other viral and bacterial pathogens that may cause influenzalike illness. These other pathogen targets of RPM-Flu may co-infect and compound the morbidity and/or mortality of patients with influenza.
DTIC
Assaying; Birds; Detection; Drugs; Infectious Diseases; Influenza; Viruses

20100019701 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Low Dose Sarin Leads To Murine Cardiac Dysfunction
Horenziak, Michael W; Mar 2010; 110 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519004; AFIT/GIH/ENV/10-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519004

It has been reported that low dose sarin is associated with long-term pathology in the brain and heart; however, the effects of sarin on the heart have yet to be determined. In addition, sarin has been implicated as an etiological agent in Gulf War Illness. Thus, the role of sarin in producing illness has important military implications. This study used echocardiography, electrocardiography, and histology to determine sarin's effect on the murine cardiovascular system. C57BL/6J mice were injected with sarin at 0.4 LD50, 0.5 LD50, or saline on two consecutive days and studied for 10 weeks post exposure. The sarin animals had marked increases in heart weight to body weight ratios ($p = 0.026$) and the left ventricular lumen size was significantly decreased ($p = 0.0014$). In addition, cardiomyocytes were significantly larger in the sarin mice ($p = 0.025$), and atrial/brain natriuretic peptide levels were increased ($p = 0.028$ and 0.010, respectively). Results of the electrocardiograms show significant ST/T-wave changes in the sarin groups ($p = 0.0015$ and 0.032, respectively). Similarly, echocardiograms showed significantly decreased performance of the left ventricle in the sarin animals. This study indicates that sarin plays a role in cardiac remodeling and reducing cardiac performance.
DTIC
Cardiovascular System; Dosage; Heart; Heart Function; Rodents

20100019705 New York Univ., New York, NY USA
DNA-Based Photonic Bandgap Structures and Devices
Seeman, Nadrian C; Cui, Hong-Liang; Nov 29, 2009; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-05-1-0120
Report No.(s): AD-A519008; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519008

We proposed to address the scientific and engineering challenges associated with developing and demonstrating DNA-based wave-guiding devices that incorporate radiation-sensitive bio-molecules to define new architectures that can be used to control and manipulate information propagation at the nanoscale. Prof. N. Seeman, of New York University (NYU), has led the effort to define an advanced methodology for the precision-placement of self-assembled bio-systems and implement structures that incorporate frequency-selective, radiation-sensitive molecular elements. Prof. Seeman remains the world-leader in DNA-based nanofabrication and has pioneered methods (e.g., Seeman tiles) for the construction of periodic/aperiodic and symmetric/asymmetric bio-structures. Prof. H.-L. Cui, of Stevens Institute of Technology (SIT) has led the effort for defining the DNA-based photonic bandgap crystal devices and perform physics-based modeling of their wave-guiding properties. Prof. Cui is an expert in solid-state physics and electronics, and has extensive experience in developing physics-based software on high-performance computing (HPC) platforms for the study of nano/molecular electronics. We have produced a number of advances in the ability to build large DNA arrays, particularly in 3D. Key advances during the period include methods for self-assembling 3D crystals with multiple components and for making arrays of DNA origami crystals. Significant calculations were performed by the Cui group.
DTIC
Deoxyribonucleic Acid; Energy Gaps (Solid State); Photonics

20100019716 Georgetown Univ., Washington, DC USA
Long Term Outcomes of BRCA1/BRCA2 Mutation Testing
Schwartz, Marc D; Aug 2007; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0553
Report No.(s): AD-A519028; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519028

This project aims to gain a better understanding of the implications of genetic testing for breast-ovarian cancer susceptibility. The primary goal is to evaluate the impact of BRCA1/BRCA2 mutation testing on long term psychosocial (quality of life, distress, social functioning) and prevention/surveillance (mammography, CA125, transvaginal ultrasound, prophylactic mastectomy, prophylactic oophorectomy and chemoprevention) outcomes. To accomplish this we will measure outcomes within a group of women who received BRCA1/BRCA2 test results at least four years ago. We will divide our sample based upon their personal cancer history ? evaluating cancer survivors with different measures compared to unaffected individuals. For both survivors and unaffected individuals we will recruit separate comparison samples of women who have never received BRCA1/BRCA2 testing. During this past year we received final approval from the DOD to begin accrual. We have initiated accrual and to date have completed follow-up interviews with xxx women. During the upcoming year we will continue accrual of our genetic testing cohort and will initiate accrual of our comparison groups.
DTIC
Breast; Cancer; Genes; Mammary Glands; Mutations; Ovaries

20100019724 Connecticut Univ. Health Center, Farmington, CT USA
Mechanisms of the Killing and Development of Spores of Bacillus Species
Setlow, Peter; Oct 29, 2009; 3 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0428
Report No.(s): AD-A519056; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519056

Notable findings in the final year of support include the following. 1) The proteins that comprise the mechanosensitive channels were fused to Green Fluorescent Protein (GFP) and localized in Bacillus subtilis cells. All of these proteins were in the plasma membrane, and at least two may be in a helical array. 2) The phospholipid composition of B. subtilis spores' inner membrane could be altered drastically without large effects on spore resistance or germination. 3) Spores of a cotE gerE mutant lacked most coat layers but retained a thin layer of insoluble coat proteins. 4) A major reason for the effort to prepare and characterize the cotE gerE spores was that it was hoped that these spores would be: a) generally stained less well by hydrophobic stains that often bind non-specifically to the spore's outer layer(s), presumably by adsorbing to spore coats; stains

in this category include nucleic acid stains such as DAPI and acridine orange, as well as various membrane potential-sensitive dyes; and b) less autofluorescent. 5) Dormant B. subtilis spores give a distinctive X-ray scattering pattern. We used spores of mutants lacking the DNA protective alpha/beta-type small, acid-soluble spore proteins, as well as cotE, gerE and cotE gerE spores to show that one or more coat proteins under the direct or indirect control of the GerE transcription factor is responsible for the X-ray scattering. 6) We studied the physical state of water in B. subtilis spores. This work led to three major conclusions: a) the water in the spore core is not in a glass-like state; b) proteins in the spore core are rotationally immobilized; and c) the rate of permeation of water across the spore's inner membrane is at least several orders of magnitude slower than rates of permeation across a growing cell membrane.
DTIC
Bacillus; Spores

20100019757 Naval Medical Research Inst., Bethesda, MD USA
Q Fever in US Military Returning from Iraq
Gleeson, Todd D; Decker, Catherine F; Johnson, Mark D; Hartzell, Joshua D; Mascola, John R; Jan 2007; 3 pp.; In English
Report No.(s): AD-A519165; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519165

Q fever is a zoonotic infection caused by Coxiella burnetii that may present with acute or chronic clinical manifestations, including a nonspecific febrile illness, pneumonia, hepatitis, or endocarditis. Although unusual in the US, Q fever is endemic in the Middle East. Our case series raises the concern that Q fever may be a significant infectious disease threat to US military serving in Iraq.
DTIC
Fever; Iraq; Military Personnel

20100019764 Naval Medical Research Inst., Portsmouth, VA USA
Skill Set Requirements for Nurses Deployed with an Expeditionary Medical Unit Based on Lessons Learned
Whitcomb, John J; Newell, Kimberly J; Jan 2008; 11 pp.; In English
Report No.(s): AD-A519175; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519175

Based in Kuwait 3 years apart, the authors recount how nurses and corps staff, along with their physician counterparts, came together to form well-run medical facilities under adverse circumstances. Their respective hospitals became competent organizations because of specific formulas for success, along with preparation, identification of required skill sets, and making improvements based on experience. This article describes the training of medical, nursing, and corps staff, the facilities and resources required for managing casualties, and some of the more commonly encountered combat injuries and conditions.
DTIC
Deployment; Kuwait; Lessons Learned; Medical Personnel; Medical Services; Military Operations; Modulation Transfer Function

20100019765 Naval Medical Research Inst., Bethesda, MD USA
Stateside Care of Marines and Sailors Injured in Iraq at the National Naval Medical Center in Bethesda, Maryland
Aiken, Loretta J; Bibeau, Patrice; Cilento, Barbie; Lopez, Eddie; Jan 2008; 11 pp.; In English
Report No.(s): AD-A519177; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519177

The National Naval Medical Center (NNMC) is located in Bethesda, Maryland, just outside of Washington, DC. It is often referred to simply as the Naval Hospital and is considered by the US Navy to be the flagship of navy medicine [1]. This world-renowned teaching hospital complex has provided care to war heroes serving in the USA military for more than 65 years. It is also referred to as the President's Hospital, whose mission is to assure the readiness and care of the uniformed services and their families [1]. Before the start of the current conflict, it had been several years since the USA was involved in major combat operations. As a result, health care providers had limited experience in treating traumatic injuries associated with war fighting and the sequelae of infection and sepsis. Early lessons were learned in 2003 aboard the USA Naval Ship Comfort Tanker-Auxiliary Hospital 20 while treating primarily Iraqi soldiers, civilians, and some members of the coalition forces [2]. For the first time, many of the ICU team members were exposed to patients who had gunshot wounds, traumatic amputations, open and closed head injuries, blunt and penetrating blast injuries, burns covering a large body surface area, acute respiratory distress syndrome, and sepsis. Those experiences helped refine the approach taken to care for the service members

and civilians who are critically injured and arrive at NNMC by way of the US Air Force Medical Evacuation (MEDEVAC) system.
DTIC
Iraq; Medical Services

20100019766 Naval Medical Research Inst, Yokosuka, Japan
Scientific Resistance to Research, Training and Utilization of Eye Movement Desensitization and Reprocessing (EMDR) Therapy in Treating Post-War Disorders
Russell, Mark C; Jan 2008; 11 pp.; In English
Report No.(s): AD-A519179; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519179

In this study, Barber's [(1961). Resistance by scientists to scientific discovery. Science, 134, 596-602] analysis of scientists' resistance to discoveries is examined in relation to an 18-year controversy between the dominant cognitive-behavioral paradigm or zeitgeist and its chief rival - eye movement desensitization and reprocessing (EMDR) in treating trauma-related disorders. Reasons for persistent opposition to training, utilization and research into an identified 'evidence-based treatment for post-traumatic stress disorder' (EBTPTSD) within US military and veterans' agencies closely parallels Barber's description of resistance based upon socio-cultural factors and scientific bias versus genuine scientific skepticism. The implications of sustained resistance to EMDR for combat veterans and other trauma sufferers are discussed. A unified or super-ordinate goal is offered to reverse negative trends impacting current and future mental healthcare of military personnel, veterans and other trauma survivors, and to bridge the scientific impasse.
DTIC
Desensitizing; Education; Eye Movements; Reclamation; Therapy; Warfare

20100019767 Massachusetts Univ., Worcester, MA USA
Emergency Medical Support Units to Critical Care Transport Teams in Iraq
Collins, Sean T; Ang, Ma; Jan 2008; 12 pp.; In English
Report No.(s): AD-A519185; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519185

The imagery of warfare has never been so easily accessible to the public. The sights and sounds of war can be viewed almost instantaneously on the evening news or seen on the Internet. The shadow of war has been cast upon several generations in the USA, but perhaps never with such immediate processing. Some of my earliest recollections of war were seeing clips of the Vietnam War on the daily evening news. Those news clips showed soldiers in the jungles of a distant land, carrying machine guns and helping their injured buddies. The news brought the grittiness of war into our living rooms. The carnage of war was tempered; however, the average citizen could recognize the destruction of battle.
DTIC
Emergencies; Iraq; Medical Services

20100019768 Mount Sinai Hospital, Toronto, Ontario Canada
Analysis of Dachsous2 in Breast Cancer Progression and Recurrence
McNeill, Helen; Oct 2009; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0631
Report No.(s): AD-A519188; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519188

Microarray analysis of tumors women with axillary node negative (ANN) breast cancer revealed that a cDNA for Dachsous 2 (Ds2) is one of the most highly discriminatory genes in tumors from patients who had experienced early recurrence, compared to tumors from patients who did not recur for at least ten years (p= 1.1 x 10-5 by students t-test). This suggests that increased transcription of Ds2 may be a predictive indicator of recurrence in ANN breast cancer. Ds2 encodes a large cell adhesion molecule1. The Drosophila homolog of Ds2, Ds, functions as a planar cell polarity (PCP) ligand for the large cadherin Fat(2-5), and together Ds and Fat regulate tissue organization through a PCP signaling pathway. Recent data has also linked Ds with a newly described growth control pathway, the Hippo kinase pathway(6-9). To determine the significance of the increased levels of Ds2 in recurrence we will: 1) Validate gene expression array results and determine if Ds2 proteins levels increase in tumors 2) Determine if PCP or Hippo pathway gene expression is altered upon Ds2

overexpression. 3) Determine the effects of altering Ds2 levels on proliferation and tumor susceptibility in the mouse.
DTIC
Breast; Cancer; Mammary Glands

20100019769 University of South Florida, Tampa, FL USA
Evaluating PTSD on Reproductive Outcomes: Women Deployed in Iraq and Afghanistan
O'Rourke, Kathleen; Oct 2009; 24 pp.; In English
Contract(s)/Grant(s): W81XWH-08-2-0190
Report No.(s): AD-A519190; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519190

Women represent nearly 15% of the Armed Forces and almost 11% of those deploying to support Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF) in Afghanistan. Military women who become pregnant may be exposed to factors that their civilian counterparts are less likely to experience, including Post Traumatic Stress Disorder (PTSD). The purpose of this study is to determine if PTSD and other mental disorders are significantly associated with maternal and newborn outcomes. The proposed study will utilize a secondary analysis of existing military records. In conjunction with our military partners, we have developed and submitted a protocol requesting de-identified data from military databases, and are awaiting receipt of the files. The study design is a retrospective cohort study: we will first define a cohort of women for whom a Tricare delivery hospitalization record can be found, and then link backward to obtain inpatient, outpatient, and screening records with PTSD (and related disorders) diagnosis codes. We will define women who were exposed (had a diagnosis of PTSD prior to pregnancy) and unexposed (did not have a diagnosis of PTSD), and compare the incidence of pregnancy outcomes for these 2 groups.
DTIC
Afghanistan; Deployment; Females; Iraq; Military Personnel; Pregnancy

20100019770 Johns Hopkins Univ., Laurel, MD USA
DARPA Revolutionizing Prosthetics 2009
McLoughlin, Michael P; Jan 2009; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519193; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519193

Produce a fully neurally integrated upper extremity prosthetic with appropriate documentation for clinical trials, FDA approvals, and manufacturing integrated systems, transition. Apply an understanding of the underlying function and control of the human arm and hand when performing the basic functions of reaching, pointing, grasping, and coordinated finger movements to the design of this prosthetic. Understand and address the amputees needs to promote and enhance quality of life issues - comfort, cosmesis, natural control, integrated sensory feedback.
DTIC
Artificial Intelligence; Prosthetic Devices; Social Factors

20100019771 Mount Sinai School of Medicine, New York, NY USA
Ketamine as a Rapid Treatment for Post-Traumatic Stress Disorder
Charney, Dennis; Oct 2009; 5 pp.; In English
Contract(s)/Grant(s): W81XWH-08-1-0602
Report No.(s): AD-A519196; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519196

Post-traumatic stress disorder (PTSD) is a debilitating anxiety disorder characterized by intrusive re-experiences of the traumatic events, avoidance of situations and stimuli that could serve as reminders of these events, and chronic hypervigilance. Patients with PTSD are often also depressed, and many have significant memory impairments. Existing drug treatments are unsuccessful in a majority of patients, especially in those with combat-related PTSD. The primary aim of this study is to test the efficacy of a single sub-anesthetic IV dose of ketamine in providing rapid relief of symptoms in patients with active PTSD. A factor that must be considered, however, is that ketamine is known to impair memory function. Because of this, ketamine-induced memory impairment also will be tested as a predictor of outcome. The effects of ketamine will be compared with that of the commonly used benzodiazepine anesthetic, midazolam, which is expected to mimic some of the acute dissociative effects of ketamine but not have any sustained anxiolytic and antidepressant effects. Forty individuals diagnosed with post-traumatic stress disorder, combat-related or civilian-related, will be included in the study. Recruitment began in

March 2009 and first patient was randomized at the end of May 2009. To date, seven people have been randomized, five of whom have completed the study procedures.
DTIC
Analgesia; Anesthetics; Drugs; Signs and Symptoms

20100019774 Pennsylvania Univ., Philadelphia, PA USA
Exploring Neurofibromin Function in a Yeast Model of NF1
Gitler, Aaron; Sep 2009; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0538
Report No.(s): AD-A519204; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519204

We hypothesized that the NF1 protein Neurofibromin has functions in addition to its Ras-GAP activity and proposed to develop a yeast NF1 model to define new functions as well as novel regulators of known functions. In year 1 of this project, we categorized genetic hits that we recovered from yeast screens. We divided hits into Ras-dependent and Ras-independent categories. To do this, we used two approaches. First, we assayed mutant yeast strains from our screens by idodine staining, providing an indirect readout for ras signaling levels. For strains that showed elevated ras signaling, we next used Ras-GTP pull-down assays to define if the genes functioned upstream or downstream of ras. The most significant finding during the first year of this project is that we defined which of our genes that interact with IRA1 or IRA2 are involved in ras signaling and which are not. Furthermore, of the genes involved in ras signaling, we now have evidence placing these either upstream or downstream of ras. These data will facilitate future years of funding for this project, as we define if the genetic modifiers interact physically with Ira1 and/or Ira2, as well as generating transgenic flies to validate our results in Drosophila.
DTIC
Genetic Engineering; Models; Neurophysiology; Yeast

20100019775 Washington State Univ., Pullman, WA USA
Diagnostic and Therapeutic Radiopharmaceutical Agents for Selective Discrimination of Prostate Cancer
Benny, Paul; Oct 2009; 53 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0556
Report No.(s): AD-A519205; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519205

The project investigated the development of ligand linked Flutamide analogs for complexing M(CO)3 (Re,99mTc) organometallic species to target prostate cancer. The project has been successful in developing and testing new synthetic strategies for this application. General methods were established for preparing the cold Re and 99mTc complexes in excellent yields(95%) at (10-4,10-5 M) ligand concentration, testing the stability of the complexes (pH, temperature) and in vitro (serum, AR +/- prostate cancer cells). Several 99mTc flutamide analogs were examined. Tridentate ligands (i.e., cysteine, histidine, dipyridylamine, iminodiacetic acid) were successfully prepared and maintained stability in vitro. The 2+1 approach analogs were prepared, however, failed to maintain the complex conformation, when examined under biological conditions. Second generation compounds based on the initial experiments with addition functional group are currently being investigated.
DTIC
Cancer; Pharmacology; Prostate Gland; Radioactive Isotopes; Therapy

20100019778 Army Research Inst. of Environmental Medicine, Natick, MA USA
Demographic, Physical, and Mental Health Factors Associated with Deployment of U.S. Army Soldiers to the Persian Gulf
Bell, Nicole S; Amoroso, Paul J; Williams, Jeffrey O; Yore, Michelle M; Engel, Jr , Charles C; Senier, Laura; DeMattos, Annette C; Wegman, David H; Apr 2010; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8610
Report No.(s): AD-A519216; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519216

A total of 675,626 active duty Army soldiers who were known to be at risk for deployment to the Persian Gulf were followed from 1980 through the Persian Gulf War. Hospitalization histories for the entire cohort and Health Risk Appraisal surveys for a subset of 374 soldiers were used to evaluate prewar distress, health, and behaviors. Deployers were less likely to have had any prewar hospitalizations or hospitalization for a condition commonly reported among Gulf War veterans or to

report experiences of depression/suicidal ideation. Deployers reported greater satisfaction with life and relationships but displayed greater tendencies toward risk taking, such as drunk driving, speeding, and failure to wear safety belts. Deployed veterans were more likely to receive hazardous duty pay and to be hospitalized for an injury than nondeployed Gulf War-era veterans. If distress is a predictor of postwar morbidity, it is likely attributable to experiences occurring during or after the war and not related to prewar exposures or health status. Postwar excess injury risk may be explained in part by a propensity for greater risk taking, which was evident before and persisted throughout the war.
DTIC
Deployment; Mental Health; Military Personnel; Persian Gulf; Physical Factors

20100019783 Brooke Army Medical Center, Fort Sam Houston, TX USA
Fresh Frozen Plasma
Simon, Clayton D; Perkins, Jeremy; Barras, Paul; Eastridge, Brian; Blackbourne, Lorne H; Mar 2009; 5 pp.; In English
Report No.(s): AD-A519234; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519234

For years, much has been said and written concerning transfusion practices in the massively bleeding patient. It makes intuitive sense to transfuse whole blood into the massively bleeding patient since that is exactly what the patient is losing. However, since whole blood is not a product that is available for common hospital use, crystalloids and packed cells are commonly infused to treat the massively bleeding. Infusing a crystalloid solution (normal saline or lactated Ringer's solution) or stored packed red blood cells without clotting factors into a hemorrhaging patient will dilute the clotting factors and can actually make the patient more coagulopathic. Coagulopathy clearly correlates with mortality in severely injured damage control patients. Combat injured casualties represent a unique subset of these patients, often with massive tissue injury. While administering packed red blood cells replaces oxygen carrying capacity, it is deficient in coagulation factors. Whole blood administration accomplishes both red cell and plasma replacement, but it is both labor and time intensive. Aggressively replacing the lost clotting factors approaching a 1:1 ratio of FFP to pRBCs should be a goal in all abbreviated damage control operations and intensive care unit resuscitation of all severely injured patients undergoing a massive blood transfusion (10 units of pRBCs in 24 hours) in the combat zone. This is accomplished by assuring FFP is readily available and pushing FFP far forward to surgical facilities on the battlefield. There have been many recent discussions on the benefits of FFP in combat wounded; this paper provides some basic information on the subject.
DTIC
Blood; Blood Plasma; Erythrocytes; Freezing; Hemorrhages; Plasmas (Physics); Transfusion

20100019784 Army Medical Dept. Center and School, Fort Sam Houston, TX USA
Should We Teach Every Soldier How to Start Intravenous Fluids?
Mabry, Robert L; Cuenca, Peter J; Mar 2009; 4 pp.; In English
Report No.(s): AD-A519235; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519235

The recent mandate by the U.S. Army Training and Doctrine Command requiring all Soldiers entering Basic Combat Training after October 1, 2007, to be combat lifesaver (CLS) certified is an outstanding step to improve training across the Army in lifesaving first-aid skills. However, the requirement for all Soldiers to be competent in placing an intravenous (IV) line and initiating treatment with IV fluids, per the current CLS standards, may not be the best use of precious training resources in light of the most recent medical research and battlefield experience. The most important battlefield first-aid skill is controlling hemorrhage, by far the leading and most preventable cause of battlefield death in modern warfare. The main purpose of performing IV catheterization in the setting of trauma is to administer fluids or blood products to treat hemorrhagic shock. For patients in significant hemorrhagic shock, aggressive hemorrhage control at the point of wounding, followed by expeditious transport to surgical care, is most important. Evacuation and subsequent surgical management of noncompressible truncal hemorrhage should not be delayed by attempts to place an IV. Based on the available literature and lessons learned in Iraq and Afghanistan, it is clear that IV placement is not a critical life-saving skill, while hemorrhage control is. Training all Soldiers to start IVs without the requisite understanding of the risks and benefits of who would benefit from IV fluids and who could be harmed could result in many receiving unneeded or detrimental care on the battlefield. Soldiers spend the vast majority of their first-aid training time learning IV placement, the most time-consuming skill in the CLS course, yet one that does not save lives. The only units that may benefit from IV training are units operating far forward with little or no organic medical support, such as Special Operations Forces.
DTIC
Blood; Cannulae; Education; First Aid; Hemorrhages; Insertion; Intravenous Procedures; Transfusion

20100019785 Air Force Research Lab., Brooks AFB, TX USA

Effects of Low-Level Radio-Frequency (3 kHz to 300 GHz) Energy on Human Cardiovascular, Reproductive, Immune, and Other Systems: A Review of the Recent Literature

Jauchem, James R; Jan 2008; 30 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A519240; AFRL-HE-BR-JA-2006-0018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519240

Occupational or residential exposures to radio-frequency energy (RFE), including microwaves, have been alleged to result in health problems. This paper is a narrative review of the recent medical and scientific literature (from mid-1998 through early 2006) dealing with possible effects of RFE on humans, relating to topics other than cancer, tumors, and central nervous system effects (areas covered in a previous review). Subject areas in this review include effects on cardiovascular, reproductive, and immune systems. Although both beneficial and negative detrimental effects were reported in some studies, in a majority of instances no significant health effects were found. Consistent, strong associations were not found for RFE exposure and adverse health effects. Most findings of investigations were not consistent with health hazards. On the basis of previous reviews of older literature and the current review of recent literature, one can conclude that the evidence for any proven health effects (related to the topics above) of low-level RFE exposure is minimal.

DTIC

Cardiovascular System; Conditions; Hazards; Radio Frequencies; Surveys

20100019791 Texas Univ., Dallas, TX USA

PSMA-Targeted Nano-Conjugates as Dual-Modality (MRI/PET) Imaging Probes for the Non-Invasive Detection of Prostate Cancer

Sun, Xiankai; Jan 2010; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0592

Report No.(s): AD-A519262; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519262

The goal of this project is to develop dual modality imaging probes for the detection of prostate cancer by doping radioisotopes to iron oxide nanoparticles, so that the sensitivity and specificity of prostate cancer diagnosis could be significantly improved. During the funding period, a facile approach was developed to prepare gamma- or positron emitting nuclides incorporated SPIO nanoparticles (NUSPIONs) for dual modality imaging of prostate cancer. In this three-month extension, we successfully developed the logistics of importing 74As/GeO2 targets from Europe and developed a standardized operation protocol for the isotope separation and 74AsI3 preparation. Using 74AsI3, we have applied our developed methodology to synthesize 74As incorporated detxtran-coated iron oxide nanoparticles (20 nm) and performed PET-CT and MRI evaluation in a PC-3 tumor mouse model. The PET/MRI dual modality imaging results clearly demonstrated the practicality of the methodology conceived and developed in this project for non-invasive detection of prostate cancer. Further research is warranted to move this project forward.

DTIC

Cancer; Conjugates; Imaging Techniques; Prostate Gland

20100019796 Naval Health Research Center, San Diego, CA USA

Complementary and Alternative Medicine Use Among US Navy and Marine Corps Personnel

Smith, Tyler C; Ryan, Margaret K; Smith, Besa; Reed, Robert J; Riddle, James R; Gumbs, Gia R; Gray, Gregory C; May 16, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519278; NHRC-07-25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519278

Background: Recently, numerous studies have revealed an increase in complementary and alternative medicine (CAM) use in US civilian populations. In contrast, few studies have examined CAM use within military populations, which have ready access to conventional medicine. Currently, the prevalence and impact of CAM use in US military populations remains unknown. Methods: To investigate CAM use in US Navy and Marine Corps personnel, the authors surveyed a stratified random sample of 5,000 active duty and Reserve/National Guard members between December 2000 and July 2002. Chi-square tests and multivariable logistic regression were used to assess univariate associations and adjusted odds of CAM use in this population. Results and discussion: Of 3,683 service members contacted, 1,446 (39.3%) returned a questionnaire and 1,305 gave complete demographic and survey data suitable for study. Among respondents, more than 37% reported using at least

one CAM therapy during the past year. Herbal therapies were among the most commonly reported (15.9%). Most respondents (69.8%) reported their health as being very good or excellent. Modeling revealed that CAM use was most common among personnel who were women, white, and officers. Higher levels of recent physical pain and lower levels of satisfaction with conventional medical care were significantly associated with increased odds of reporting CAM use. Conclusion: These data suggest that CAM use is prevalent in the US military and consistent with patterns in other US civilian populations. Because there is much to be learned about CAM use along with allopathic therapy, US military medical professionals should record CAM therapies when collecting medical history data.
DTIC
Medical Services; Military Operations; Military Personnel; Navy

20100019862 Naval Medical Research Inst., Bethesda, MD USA
The Lantern: The Journal of Nursing Stories. Winter 2010
Jan 2010; 19 pp.; In English
Report No.(s): AD-A519283; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For nearly 25 years, the Bureau of Medicine and Surgery (BUMED) has actively sought out the memories of Navy and civilian medical/nursing personnel. Inspired by this project, the Navy Nurse Corps has conducted over 500 oral history interviews with Nurse Corps officers. A few of these oral histories pre-date World War II, but the majority of these stories are of the women who served in World War II, Korea, and Vietnam. It is the mission of this journal to present the stories of the triumph of nursing spirit and to impress the importance of sharing the accumulated wisdom, beliefs, and values.
DTIC
Medical Personnel; Navy; Winter

20100019863 Army Inst. of Surgical Research, Fort Sam Houston, TX USA
Characterization of Craniomaxillofacial Battle Injuries Sustained by USA Service Members in the Current Conflicts of Iraq and Afghanistan
Lew, Timothy A; Walker, John A; Wenke, Joseph C; Blackbourne, Lorne H; Hale, Robert G; Jan 2009; 6 pp.; In English
Report No.(s): AD-A519286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To characterize and describe the craniomaxillofacial (CMF) battlefield injuries sustained by US Service Members in Operation Iraqi Freedom and Operation Enduring Freedom. The Joint Theater Trauma Registry was queried from October 19, 2001, to December 11, 2007, for CMF battlefield injuries. The CMF injuries were identified using the International Classification of Diseases, Ninth Revision, Clinical Modification codes and the data compiled for battlefield injury service members. Nonbattlefield injuries, killed in action, and return to duty cases were excluded. CMF battlefield injuries were found in 2,014 of the 7,770 battlefield-injured US service members. In the 2,014 injured service members were 4,783 CMF injuries (2.4 injuries per soldier). The incidence of CMF battlefield injuries by branch of service was Army, 72%; Marines, 24%; Navy, 2%; and Air Force, 1%. The incidence of penetrating soft-tissue injuries and fractures was 58% and 27%, respectively. Of the fractures, 76% were open. The location of the facial fractures was the mandible in 36%, maxilla/zygoma in 19%, nasal in 14%, and orbit in 11%. The remaining 20% were not otherwise specified. The primary mechanism of injury involved explosive devices (84%). Of the injured US service members, 26% had injuries to the CMF region in the Operation Iraqi Freedom/Operation Enduring Freedom conflicts during a 6-year period. Multiple penetrating soft-tissue injuries and fractures caused by explosive devices were frequently seen. Increased survivability because of body armor, advanced battlefield medicine, and the increased use of explosive devices is probably related to the elevated incidence of CMF battlefield injuries. The current use of International Classification of Diseases, Ninth Revision, Clinical Modification codes with the Joint Theater Trauma Registry failed to characterize the severity of facial wounds.
DTIC
Afghanistan; Explosive Devices; Injuries; Iraq; United States

20100019869 Tuskegee Inst., AL USA
The Role of Tumor Microenvironment on Prostate Cancer Progression
Yates, Clayton; Aug 2009; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XMH-08-1-0462
Report No.(s): AD-A519305; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Current therapies for invasive and metastatic prostate cancer are not curative and prolong survival by nearly a year even in patients with a metastatic disease. Metastasis is a multi-step process wherein tumor cells acquire properties that enable them

to detach, migrate, gain access to conduits, and disseminate throughout the body. The dissemination of cancer from the primary carcinoma mass requires a loosening of the cell-cell bonds. Previous investigations have demonstrated that the epidermal growth factor receptor (EGFR) promotes tumor cell invasiveness and metastasis. However, the regulatory control of metastasis genes have not explored the key molecular events mediated by the EGFR induced responses. Recently, Kaiso a biomodal transcription factor, has been shown to be associated with, many cancer-related genes which function as tumor suppressor, such as cell cycle regulator CDKN2A (P16), TIMPS and E-cadherin. However, a direct link between Kaiso and metastasis as not been shown. Therefore, we hypothesized that Kaiso fits into the EGFR signaling cascade, and is associated with EGFR induced cell migration and metastasis.
DTIC
Cancer; Metastasis; Position (Location); Prostate Gland; Proteins; Tumors

20100019870 Naval Health Research Center, San Diego, CA USA
Millennium Cohort: Enrollment Begins A 21-Year Contribution to Understanding the Impact of Military Service
Ryan, Margaret A; Smith, Tyler C; Smith, Besa; Amoroso, Paul; Boyko, Edward J; Gray, Gregory C; Gackstetter, Gary D; Riddle, James R; Wells, Timothy S; Gumbs, Gia; Corbeil, Thomas E; Hooper, Tomoko I; Jan 2007; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519306; NHRC-05-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objective: In response to health concerns of military members about deployment and other service-related exposures, the Department of Defense (DoD) initiated the largest prospective study ever undertaken in the U.S. military. Study Design and Setting: The Millennium Cohort uses a phased enrollment strategy to eventually include more than 100,000 U.S. service members who will be followed up through the year 2022, even after leaving military service. Subjects will be linked to DoD and Veterans Affairs databases and surveyed every 3 years to obtain objective and self-reported data on exposures and health outcomes. Results: The first enrollment phase was completed in July 2003 and resulted in 77,047 consenting participants, well representative of both active-duty and Reserve/Guard forces. This report documents the baseline characteristics of these Cohort members, describes traditional, postal, and Web-based enrollment methods; and describes the unique challenges of enrolling, retaining, and following such a large Cohort. Conclusion: The Millennium Cohort was successfully launched and is becoming especially relevant, given current deployment and exposure concerns. The Cohort is representative of the U.S. military and promises to provide new insight into the long-term effects of military occupations on health for years to come.
DTIC
Deployment; Health; Medical Services; Military Operations; Military Personnel

20100019875 Marshall Univ., Huntington, WV USA
Maternal Consumption of Canola Oil Suppressed Mammary Gland Tumorigenesis in C3(1) TAg Mice Offspring
Ion, Gabriela; Akinsete, Juliana A; Hardman, W E; Mar 6, 2010; 14 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0450
Report No.(s): AD-A519345; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background: Maternal consumption of a diet high in omega 6 polyunsaturated fats (n-6 PUFA) has been shown to increase risk whereas a diet high in omega 3 polyunsaturated fats (n-3 PUFA) from fish oil has been shown to decrease risk for mammary gland cancer in female offspring of rats. The aim of this study was to determine whether increasing n-3 PUFA and reducing n-6 PUFA by using canola oil instead of corn oil in the maternal diet might reduce the risk for breast cancer in female offspring. Methods: Female SV 129 mice were divided into two groups and placed on diets containing either 10% w/w corn oil (which is 50% n-6 PUFA, control diet) or 10% w/w canola oil (which is 20% n-6 PUFA, 10% n-3 PUFA, test diet). After two weeks on the diets the females were bred with homozygous C3(1) TAg transgenic mice. Mother mice consumed the assigned diet throughout gestation and nursing of the offspring. After weaning, all female offspring were maintained on the control diet. Results: Compared to offspring of mothers fed the corn oil diet (CO/CO group), offspring of mothers fed the canola oil diet (CA/CO group) had significantly fewer mammary glands with tumors throughout the experiment. At 130 days of age, the CA/CO group had significantly fewer tumors per mouse (multiplicity); the tumor incidence (fraction of mice with any tumor) and the total tumor weight (per mouse that developed tumor) was less than one half that of the CO/CO group. At 170 days of age, the total tumor weight per mouse was significantly less in the CA/CO group and if a tumor developed the rate of tumor growth rate was half that of CO/CO group. These results indicate that maternal consumption of canola oil was associated with delayed appearance of mammary gland tumors and slowed growth of the tumors that developed. Conclusions: Substituting canola oil for corn oil is an easy dietary change for people to make; such a change to the maternal diet may decrease risk for breast cancer in the daughter.
DTIC
Breast; Cancer; Diets; Fats; Mammary Glands; Mice; Oils; Pregnancy; Progeny; Vegetables

20100019893 Aruna Biomedica, Inc., Athens, GA USA

Human Neural Cell-Based Biosensor

Stice, Steven L; Chilton, Jamie; Apr 26, 2010; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-10-C-0066

Report No.(s): AD-A519388; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Carbohydrates corresponding to PhaL, VVA, DBA, LTL and PNA lectin binding are up regulated upon differentiation of hESCs. In particular, VVA, DBA, LTL and PNA lectin binding increases in hNPCs but not in hMPCs. This suggests that these carbohydrates might be specific for function of hNPCs and could be used for enrichment of hNPCs from a mixed population of cells. In future work VVA and PNA lectins will be used to isolate a pure population of HNPCs and used for developing a neural progenitor cell based biosensor.

DTIC

Bioinstrumentation; Carbohydrates; Genes; Stem Cells

20100019898 National Marrow Donor Program, Minneapolis, MN USA

Quarterly Performance/Technical Report of the National Marrow Donor Program

Setterholm, Michelle; Mar 31, 2010; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-08-1-1207

Report No.(s): AD-A519406; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Contingency Preparedness: Collect information from transplant centers, build awareness of the Transplant Center Contingency Planning Committee and educate the transplant community about the critical importance of establishing a nationwide contingency response plan. Rapid Identification of Matched Donors: Increase operational efficiencies that accelerate the search process and increase patient access are key to preparedness in a contingency event. Immunogenetic Studies: Increase understanding of the immunologic factors important in HSC transplantation. Critical Research in Transplantation: Create a platform that facilitates multicenter collaboration and data management.

DTIC

Bone Marrow; Emergencies; Immunology; Management Methods; Transplantation

20100019899 Naval War Coll., Newport, RI USA

The 'Triangle of Death': Medical Sustainability in Expeditionary Sea-Based Operations

Smith, Arthur M; Jan 2008; 23 pp.; In English

Report No.(s): AD-A519409; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The futuristic concept of joint, geographically dispersed, expeditionary (or distributed) operations emanating from bases at sea entails many challenges. Among them are the formulation and design of afloat casualty-care capabilities, especially where maneuver forces are inserted into territories devoid of land-based logistic support. In expeditionary amphibious operations during the past century, ad hoc creative shipboard adaptations for treatment and salvage of the combat wounded occasionally proved successful and functionally effective. If flexible and adaptive joint operational medical support is to be made available in the future, an appreciation of these historical achievements is essential. Further, if the frequently irretrievable physical deterioration of the injured? metaphorically, the triangle of death-is to be avoided, familiarity with the immediate needs of the combat wounded is likewise imperative, especially the unique requirements of wounds seen in contemporary armed conflict.

DTIC

Injuries; Medical Services; Military Operations; Seas

20100019902 Industrial Coll. of the Armed Forces, Washington, DC USA

Health Care. The State of the Industry. Spring 2008

Abbadi, Mohammed; Alsup, Carolyn; Benyshek, Carolyn; Booth, Celestine; Cossich, Fernando; Cuadrado, Juan; Dyer, Kenneth; Haverstock, Cathy; Margeson, Bradley; McPherson, Joanne; Monk, Gregory; Rosarius, Dawn; Turner, Larry; Jan 2008; 36 pp.; In English

Report No.(s): AD-A519423; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With up to forty-seven million Americans without health insurance at any given point during the year, the debate over the adequacy of the US health care system has taken on renewed vigor - including attention in this year's presidential debates. Health care spending in the USA is increasing at an unsustainable rate. In 2007, the country spent over $2.3 trillion dollars on health care - a number that is expected to increase to $4.2 trillion within the next decade. The disparities in access to health

care, the uneven quality of the health care delivered, and rising costs of health care in the US demand that this nation do better. At the heart of the debate lie three competing and interdependent objectives: improved quality (outcomes); assured access; and controlled costs. This paper proposes several policy measures for addressing this triad of objectives in order to meet current and future national security needs from the health care perspective.
DTIC
Health; Industries; Insurance (Contracts)

20100019918 Duke Univ., Durham, NC USA
Temporal Subtraction of Digital Breast Tomosynthesis Images for Improved Mass Detection
Li, Christina M; Dobbins, III, James T; Nov 2009; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0732
Report No.(s): AD-A519456; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The original goal of this project was to combine two methods developed to increase the sensitivity of breast cancer imaging digital breast tomosynthesis (DBT) and temporal subtraction. The combined technique would allow for easier and earlier detection of breast cancer than with either technique alone. Although the original scope of the project outlined using computer simulations and physical phantoms to evaluate the feasibility of the method, an IRB approved initial investigation was performed using temporally acquired DBT images of human subjects. The results showed that structural discrepancies, due to differences in positioning and compression between temporally spaced acquisitions, caused slight anatomical variations between reconstructed slices that significantly reduced registration accuracy and subtraction. Although, the feasibility of combining the two methods using simulation and physical phantoms may have shown to be promising, the initial results using actual human subject data did not indicate a significant improvement in breast cancer detection. These results prompted the change in scope of the project to focus on developing a realistic computerized breast phantom (RCBP) to be used for breast imaging research. The RCBP can be used for simulations that study imaging system design, acquisition protocols, reconstruction algorithms, and image processing techniques. The phantom developed in this project will provide a vital tool to investigate current and emerging breast imaging methods and techniques with the ability to simulate realistic, predictive patient imaging data.
DTIC
Breast; Cancer; Computerized Simulation; Detection; Mammary Glands

20100019919 Northwestern Univ., Evanston, IL USA
Calcium Homeostatasis and Mitochondrial Dysfunction in Dopaminergic Neurons of the Substantia Nigra
Surmeier, D J; Mar 2010; 57 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-1-0170
Report No.(s): AD-A519458; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Key Research Accomplishments: -the discovery that calcium entry through L-type channels during normal pacemaking elevates the sensitivity of SNc dopaminergic neurons to toxins; -the discovery that L-type calcium channels participate in but are not necessary for pacemaking; -the discovery that serum concentration of the dihydropyridine isradipine required to achieve protection of SNc dopaminergic neurons against toxins in animal models is similar to that achieved in humans by FDA approved doses; -the discovery that calcium entry through L-type channels during pacemaking elevates mitochondrial oxidant stress and leads to the engagement of a DJ-1-dependent oxidant defense system involving uncoupling proteins.
DTIC
Calcium; Cells (Biology); Diseases; Dopamine; Efferent Nervous Systems; Mitochondria; Nervous System; Neurons; Neurophysiology

20100019921 Wisconsin Univ., Madison, WI USA
Ovarian Cancer Immunotherapy Using Redirected Endogenous Anti-Gal Antibody
Sondel, Paul; Oct 2009; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0599
Report No.(s): AD-A519460; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We proposed that decorating ovarian tumor cells with alpha-Gal (using RGD*-alpha-Gal) will lead to their destruction by patients' naturally occurring antibody against alpha-Gal. We demonstrated staining of alpha-Gal+ tumor cells with FITC-conjugated IB4 lectin, as well as with human serum and secondary antibody. We also developed an in vitro assay to measure complement-dependent cytotoxicity (CDC) of tumors expressing alpha-Gal. We showed in mice that human serum

containing anti-alpha-Gal antibody induced regression of alpha-Gal -expressing L5178Y tumor. Then we tested if alpha-Gal- tumor cells that express alphaVBeta3 integrin will bind RGD*-alpha-Gal (via RGD*) to the alphaVBeta3 integrin to express sufficient alpha-Gal to allow their destruction by anti-Gal antibody and complement. Tumor cells expressing the alphaVBeta3 integrin were treated with RGD*-alpha-Gal, followed by direct staining with FITC-IB4 lectin or with anti-alpha-Gal antibody and tested for indirect detection with anti-Gal antibody or for CDC. While detection of alpha-Gal was seen at low levels in some experiments, we were not able to reproducibly show sufficient levels to enable translation into clinical treatment simulation in vitro or in mice. These results suggest that we should be pursuing means to further increase the alpha-Gal expression we can induce on these tumors prior to trying to proceed to model treatment strategies in vitro or in vivo. Novel approaches towards this goal have been proposed and are detailed in the linked annual report being submitted by our co-investigator, Dr. Laura Kiessling.
DTIC
Antibodies; Cancer; Ovaries

20100019924 Johns Hopkins Univ., Baltimore, MD USA
Ultrasound-Based Guidance for Partial Breast Irradiation Therapy
Rivaz, Hassan; Jan 1, 2010; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-09-1-0060
Report No.(s): AD-A519466; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Tracked ultrasound elastography can be used for guidance in partial breast radiotherapy by visualizing the hard scar tissue around the lumpectomy cavity. For clinical success, the elastography method needs to be robust to the sources of decorrelation between ultrasound images, specifically fluid motions inside the cavity, change of the appearance of speckles caused by compression or physiologic motions, and out-of-plane motion of the probe. In this wok, we present a novel elastography technique that is based on analytic minimization of a regularized cost function. The cost function incorporates similarity of RF data intensity and displacement continuity, making the method robust to small decorrelations present throughout the image. We also exploit techniques from robust statistics to make the method resistant to large decorrelations caused by sources such as fluid motion. The analytic displacement estimation works in real-time. Moreover, the tracked data, used for targeting the radiotherapy, is exploited for discarding frames with excessive out-of-plane motion. Simulation, phantom and patient results are presented.
DTIC
Breast; Cancer; Irradiation; Mammary Glands; Radiation Therapy; Therapy; Ultrasonics

20100019925 Illinois Univ., Chicago, IL USA
Dietary Influences on Alpha-Methylacyl-CoA Racemase (AMACR) Expression in the Prostate
Wright, Margaret E; Apr 2009; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-06-1-0414
Report No.(s): AD-A519467; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Alpha Methyl Acyl CoA Racemase (AMACR), a peroxisomal and mitochondrial enzyme, is up regulated in majority of prostate cancers (PCa). This enzyme is involved in the breakdown of phytanic & pristanic acids, which are derived primarily through the ingestion of dairy and red meat products. There are no studies done so far that have examined the relationship of this enzyme with red meat and dairy intake and therefore PCa risk. The current research focuses on examining the relationships between AMACR expression in the prostate and phytanic/pristanic acid levels in the blood and prostate. So far, 26 patients with Pca have been recruited in the study. Research staff has been trained to obtain dietary information as well as process tissue and blood samples from participants. Protocols for processing biological samples have been established. Preliminary optimization of laboratory assays including assays for quantifying AMACR using automated image analysis tools have been developed.
DTIC
Cancer; Diets; Enzymes; Methyl Compounds; Mitochondria; Prostate Gland

20100019931 Tufts Univ., Boston, MA USA
Veterinary Research Manpower Development for Defense
Anwar, M S; Sep 1, 2009; 21 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0640
Report No.(s): AD-A519481; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of this training program is to increase veterinary research manpower by providing research training

to veterinary students. The proposed training program included joint degree programs (DVM/MPH, DVM/MS-CBS and DVM/MSLAM) and the summer research program. Six trainees have graduated with two serving in the US Army Vet Corp, two engaged in biomedical research and 2 entered private practice. The 23 trainees recruited in the joint degree program are continuing their training and the 14 trainees, recruited in the summer research program, have completed their research projects. One trainee joined the US Army. No major problem was encountered with recruiting or maintaining trainee interests in the training program during the reporting period and hence we plan to continue the program as originally proposed.
DTIC
Manpower; Medical Science; Veterinary Medicine

20100019935 Special Operations Command, MacDill AFB, FL USA
Journal of Special Operations Medicine. Volume 8, Edition 3, Summer 2008
Farr, Warner D; Landers, Michelle D; Gilpatrick, Scott; Parsons, Deborah A; Schissel, Daniel J; Pennardt, Andre M; Talbot, Timothy; Lang, Gregory; Forsten, Robert D; Roberts, Richard J; Stewart, Charles; Solomon, Benjamin E; Baggett, Mark R; Thompson, David; Jan 2008; 145 pp.; In English
Report No.(s): AD-A519492; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Partial contents of this volume include the following featured articles: Thoughts on Aid Bags: Part 1; Canine Tactical Field Care: Part One; The Physical Examination and Medical Assessment; Intermittent Hypoxic Exposure Protocols to Rapidly Induce Altitude Acclimatization in the SOF Operator; Acute Mountain Sickness Prophylaxis in the SOF Operator; A Series of Special Operations Forces Patients with Sexual Dysfunction in Association with a Mental Health Condition; Mild Traumatic Brain Injury: Situational Awareness for Special Operations Medical Providers; Spontaneous Pneumopericardium, Pneumomedastinum and Subcutaneous Emphysema in a 22-year old Active Duty Soldier. Also included in this edition are articles on Tactical Combat Casualty Care Guidelines, book reviews, and information on previously published medical articles.
DTIC
Medical Services; Military Operations; Summer

20100019938 Research Triangle Inst., Research Triangle Park, NC USA
Personal Monitoring for Ambulatory Post-Traumatic Stress Disorder Assessment
Kizakevich, Paul N; Oct 2009; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-08-1-0622
Report No.(s): AD-A519499; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Personal Health Monitor (PHM) for Ambulatory PTSD (and TBI) Assessment has been developed which integrates the collection of subjective health information, daily activities and behaviors, and objective physiological and environmental measurements in a handheld data collection system. Psychometric health scales can be used in concert with self-reported daily stressors and behavioral diaries, such as work stress, dietary intake, substance use, and exercise patterns. Passive monitoring of heart rate variability enables arousal assessment, while passive motion and location sensors enable indirect assessment of mobility, vigor, and social interaction. Clinicians and research investigators are able to customize data collection protocols by selecting a subset of available assessment, diary, survey and sensor modalities to suit their needs using a set of protocol definition files and database structures. Using mobile handheld computer and smart phone technology, the PHM enables psychological health assessments on a more continuous basis than traditional clinical encounters. The PHM enables collection of personal health data with privacy and anonymity, which may improve the quality, frequency, and accuracy of the psychometric assessments.p
DTIC
Health; Medical Services; Mental Health

20100019945 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Cost of Treating Post Traumatic Stress Disorder and Mild Traumatic Brain Injuries
Gilliland, Amy L; Mar 2010; 90 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519509; AFIT/GFA/ENV/10-M01; XC-711-HPW/RHCB; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mild Traumatic Brain Injuries (mTBIs) and Post Traumatic Stress Disorder (PTSD) are two of the signature wounds of war. Due to the advances in technology the survival rates are higher than in previous wars, however, the weaponry has changed. The world has seen an increase in the use of suicide bombs, improvised explosive devices and rocket propelled grenades which increases the number of blast related injuries. One of the major problems with blast related injuries is that they

can be invisible to the naked eye. The lack of physical evidence suggests the soldier is not injured and can be sent back into battle, when there could be an undetected internal injury. Due to the overlap in symptoms, many soldiers are being treated for PTSD instead of mTBI, which can cause long-term damage. In order to shed light on this issue, this thesis evaluates 2007-2008 active duty medical costs to determine the costs the PTSD and mTBI. The findings suggest that mTBI and PTSD account for .53% and 1.8%, respectively, of the 2008 population data sample. While this may seem like a small percentage this was only two months of data. However, it is important to properly diagnose mTBI and PTSD because these illnesses could cost the military member thousands of dollars in out of pocket medical costs.
DTIC
Brain Damage; Costs; Injuries; Order-Disorder Transformations; Shock (Physiology); Signs and Symptoms

20100019951 Naval War Coll., Newport, RI USA
Purple Medicine: The Case for a Joint Medical Command
Smith, Arthur M; Lane, David A; Zimble, James A; Jan 2007; 11 pp.; In English
Report No.(s): AD-A519521; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In response to a broad set of complex national security challenges of the twenty-first century, the Quadrennial Defense Review (QDR) report of February 2006 advised that all the organizations, processes, and practices within the Department of Defense be given a high degree of agility, flexibility, responsiveness, and ultimately effectiveness in supporting the joint war fighter and future national defense goals. In that connection, the 2006 QDR recommends that medical support be likewise aligned with emerging joint force employment concepts. Indeed, the Department of Defense, in conjunction with the chairman of the Joint Chiefs of Staff, had already been directed to develop an implementation plan for such a unified structure, the Joint Medical Command. An antecedent clause in the Department of Defense Program Budget Decision 753 of 23 December 2004 laid the conceptual groundwork. It directed that a plan for a Joint Medical Command be accomplished by the fiscal year 2008-2013 Program/ Budget Review. How can this intention be best brought to fruition? The organizational structure of the present military. The organizational structure of the present military hospital system predates World War II,when each service provided for all of its own health care. In the sixty years since the conclusion of that conflict, there have been numerous proposals for a unified medical command structure. Largely due to cost-containment pressure exercised by the executive branch, Congress,sand the services themselves, some cooperation has evolved in the delivery of peacetime health care to eligible Department of Defense beneficiaries in a framework known as the Military Health System (MHS). During this time no less than fifteen federally sponsored studies and numerous scholarly reports have examined the MHS, and the overwhelming majority has proposed the creation of a unified medical command.
DTIC
Medical Services; Military Operations

20100019957 Columbia Univ., New York, NY USA
Coordination of BRCA1/BARD1- and MRE11/RAD50/NBS1-dependent DNA Transactions in Breast Tumor Suppression
Gautier, Jean; Greene, Eric; Jul 2009; 11 pp.; In English
Contract(s)/Grant(s): W81XWH-08-1-0398
Report No.(s): AD-A519536; No Copyright; Avail.: Defense Technical Information Center (DTIC)

BRCA1/BARD1 and MRE11/RAD50/NBS1 (MRN) play critical roles in preventing the onset of breast tumorigenesis. This is underscored by the fact that mutations in BRCA1 are associated with the most frequent form of hereditary breast cancer and women who inherit mutations in the BRCA1 gene have an estimated lifetime risk of breast and/or ovarian carcinoma as high as 85%. In addition, mutations in NBS1, RAD50 and Mre11 are associated with increased risk for breast cancer or with sporadic breast tumors. Finally, BRCA1/BARD1 and MRN associate in to form DNA damage-specific complexes, critical for damage checkpoint signaling. To better understand the functional significances of these interactions, we propose to determine how BRCA1/BARD1 and the MRN complex cooperate in the recognition, signaling and repair of DNA damage during DNA replication and at double-stranded breaks (DSBs) induced by DNA damaging agents. We hypothesize that each protein complex influences the behavior of the other on DNA and that the roles of these proteins in the maintenance of genomic stability are ultimately dictated by their dynamic interactions on DNA. The overall objective of this collaborative effort is to understand precisely how BRCA1/BARD1 breast tumor suppressor complex orchestrates DNA transactions critical for genome stability and how this process interfaces with MRN's diverse roles.
DTIC
Breast; Cancer; Coordination; Deoxyribonucleic Acid; Genes; Mammary Glands; Proteins; Tumors

20100019959 Tulane Univ., New Orleans, LA USA

Telomerase as an Androgen Receptor-Regulated Target in Selenium Chemoprevention of Prostate Cancer

Liu, Shuang; May 1, 2009; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-08-1-0291

Report No.(s): AD-A519540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The present study is to investigate the functional significance and mechanism of selenium suppression of hTERT in human prostate cancer. We found that over-expression of hTERT attenuates the apoptosis inducing activities of selenium, supporting an important role of hTERT in selenium action in prostate cancer cells. More importantly, we found that combined bicalutamide (an anti-androgen) and selenium treatment further decreases AR transcriptional activity, hTERT expression and induces greater apoptosis than single treatment alone, indicating that selenium in combination with anti-androgen could represent a viable approach to improve the therapeutic outcome of androgen deprivation therapy. We also found that selenium can induce DNA damage response in LNCaP cells. In addition, our data showed that androgen-stimulated AR signaling induces the expression of hTERT through up-regulating hTERT promoter activity. Selenium can block the induction of hTERT by androgen, suggesting that AR signaling is mediating the inhibitory effect of selenium on hTERT expression. However, over-expression of AR is not able to reverse the effect of selenium on hTERT expression. The data indicate that in addition to change of AR protein level, other mechanism(s) might involve in this process. Additionally, we found that prostate cancer cells expressing wild-type or mutant AR respond differentially to androgen in term of hTERT expression.

DTIC

Cancer; Enzymes; Prostate Gland; Selenium; Targets

20100019961 California Univ., Los Angeles, CA USA

Cutting Edge: Resistance to Bacillus anthracis Infection Mediated by a Lethal Toxin Sensitive Allele of Nalp1b/Nlrp1b

Terra, Jill K; Cote, Christopher K; France, Bryan; Jenkins, Amy L; Bozue, Joel A; Welkos, Susan L; LeVine, Steven M; Bradley, Kenneth A; Jan 2010; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519544; TR-09-118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pathogenesis of Bacillus anthracis is associated with the production of lethal toxin (LT), which activates the murine Nalp1b/Nlrp1b inflammasome and induces caspase- 1-dependent pyroptotic death in macrophages and dendritic cells. In this study, we investigated the effect of allelic variation of Nlrp1b on the outcome of LT challenge and infection by B. anthracis spores. Nlrp1b allelic variation did not alter the kinetics or pathology of end-stage disease induced by purified LT, suggesting that, in contrast to previous reports, macrophage lysis does not contribute directly to LT-mediated pathology. However, animals expressing a LT-sensitive allele of Nlrp1b showed an early inflammatory response to LT and increased resistance to infection by B. anthracis. Data presented here support a model whereby LT-mediated activation of Nlrp1b and subsequent lysis of macrophages is not a mechanism used by B. anthracis to promote virulence, but rather a protective host-mediated innate immune response.

DTIC

Bacillus; Cutting; Infectious Diseases; Pathogenesis; Sensitivity; Toxins and Antitoxins

20100019962 Nagoya Inst. of Tech., Japan

Bioinspired Organic PV Cells Using Photosynthetic Pigment Complex for Energy Harvesting Materials

Nango, Mamoru; May 10, 2010; 15 pp.; In English

Contract(s)/Grant(s): FA4869-08-1-4030

Report No.(s): AD-A519547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is the report of a research project that used the photosynthetic pigment complex of purple bacteria or green plants and their model complexes to control the direction and orientation of complex on electrodes for developing dye-sensitized solar PV cells.

DTIC

Biomimetics; Electrons; Photosynthesis; Photovoltaic Cells; Pigments; Proteins; Solar Cells

20100019964 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Antiviral Activity of a Small-Molecule Inhibitor of Filovirus Infection

Warren, Travis K; Warfield, Kelly L; Wells, Jay; Enterlein, Sven; Smith, Mark; Ruthel, Gordon; Yunus, Abdul S; Kinch, Michael S; Goldblatt, Michael; Aman, M J; Bavari, Sina; May 2010; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519550; TR-09-129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There exists an urgent need to develop licensed drugs and vaccines for the treatment or prevention of filovirus infections.

FGI-103 is a low-molecular-weight compound that was discovered through an in vitro screening assay utilizing a variant of Zaire ebolavirus (ZEBOV) that expresses green fluorescent protein. In vitro analyses demonstrated that FGI-103 also exhibits antiviral activity against wild-type ZEBOV and Sudan ebolavirus, as well as Marburgvirus (MARV) strains Ci67 and Ravn. In vivo administration of FGI-103 as a single intraperitoneal dose of 10 mg/kg delivered 24 h after infection is sufficient to completely protect mice against a lethal challenge with a mouse-adapted strain of either ZEBOV or MARV-Ravn. In a murine model of ZEBOV infection, delivery of FGI-103 reduces viremia and the viral burden in kidney, liver, and spleen tissues and is associated with subdued and delayed proinflammatory cytokine responses and tissue pathology. Taken together, these results identify a promising antiviral therapeutic candidate for the treatment of filovirus infections.
DTIC
In Vitro Methods and Tests; In Vivo Methods and Tests; Infectious Diseases; Inhibitors; Vaccines; Viral Diseases; Viruses

20100019965 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Protection of Nonhuman Primates Against Two Species of Ebola Virus Infection With a Single Complex Adenovirus Vector
Pratt, William D; Wang, Danher; Nichols, Donald K; Luo, Min; Woraratanadharm, Jan; Dye, John M; Holman, David H; Dong, John Y; Apr 2010; 11 pp.; In English
Report No.(s): AD-A519551; TR-09-052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ebola viruses are highly pathogenic viruses that cause outbreaks of hemorrhagic fever in humans and other primates. To meet the need for a vaccine against the several types of Ebola viruses that cause human diseases, we developed a multivalent vaccine candidate (EBO7) that expresses the glycoproteins of Zaire ebolavirus (ZEBOV) and Sudan ebolavirus (SEBOV) in a single complex adenovirus-based vector (CAdVax). We evaluated our vaccine in nonhuman primates against the parenteral and aerosol routes of lethal challenge. EBO7 vaccine provided protection against both Ebola viruses by either route of infection. Significantly, protection against SEBOV given as an aerosol challenge, which has not previously been shown, could be achieved with a boosting vaccination. These results demonstrate the feasibility of creating a robust, multivalent Ebola virus vaccine that would be effective in the event of a natural virus outbreak or biological threat.
DTIC
Adenoviruses; Democratic Republic of Congo; Infectious Diseases; Microorganisms; Pathogens; Primates; Protection; Viruses

20100019966 Johns Hopkins Univ., Baltimore, MD USA
Identification and Characterization of Genomic Amplifications in Ovarian Serous Carcinoma
Wang, Tian-Li; Jul 2009; 136 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0004
Report No.(s): AD-A519552; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this proposed study is to apply genome-wide technologies to analyze ovarian cancer genome and transcriptome. We have accomplished all the proposed tasks as stated in the original grant. They include generating digital karyotyping libraries from ovarian carcinomas and perform transcirptome analysis in each amplicon. This effort leads us to identify at least two novel candidate oncogenes, Rsf1 and Notch3, which were up-regulated in both genomic DNA and transcript levels in ovarian cancer. In a large-scale FISH analysis, Rsf1 gene amplification was found to be correlated with a worse disease outcome. Furthermore, Rsf1 overexpression was found to lead to taxol resistance, which may explain why patient with Rsf1 amplification has a shorter overall survival. Because of recent advances in technology refinement, we have found that high density SNP array can provide a similar performance as digital karyotyping. Due to its lower cost, we are able to perform SNP array on more than 80 affinity purified ovarian serous tumors, initially with 10K platform and later on with 250K array platform. Our results demonstrated that CCNE1, Notch3, Rsf1, AKT2 and PIK3CA were among the most frequently amplified loci in high-grade ovarian serous carcinomas. In addition, we have further characterized the biological functions of the two commonly amplified genes, Notch3 and Rsf1. Our study is the first comprehensive analysis of the detailed copy number profiles in ovarian cancerors. The results from this study shall provide a new insight into how amplified or deleted genes contribute to survival and growth advantages in ovarian cancer cells.
DTIC
Cancer; Genome; Ovaries

20100019967 Fox Chase Cancer Center, Philadelphia, PA USA

A Model System to Investigate the Effect of BRCA1 and/or p53 Inactivation in the Ovarian Stroma on Growth and Transformation Potential of the Ovarian Epithelium

Connolly, Denise C; Oct 2009; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0301

Report No.(s): AD-A519554; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Women carrying germline mutations in BRCA1 are at high risk for developing ovarian cancer and mutations in p53 are frequently detected in ovarian tumors. The tumor microenvironment plays an important role in cancer progression. The tumor stroma promotes angiogenesis and is a source of growth factors, chemokines, and extracellular matrix (ECM) molecules that promotes carcinoma progression. We investigated the effects of loss of function of BRCA1 or BRCA1 and Trp53 in the stroma on the growth and neoplastic transformation of epithelial cells using 2D and 3D in vitro cell culture models. A growing number of studies suggest that selective inactivation of BRCA1 or p53 in the stroma surrounding tumors plays a direct role in tumor progression. Therefore, to directly test the hypothesis that stromal cells exert cell-nonautonomous effects on ovarian epithelial cell growth and neoplastic transformation, we examined the effects of culturing mouse ovarian surface epithelial (MOSE) cells with ECM and conditioned media from stromal cells in which BRCA1 or BRCA1 and Trp53 were inactivated.

DTIC

Cancer; Deactivation; Epithelium; Genes; Ovaries

20100019968 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Continuing Evolution of Burkholderia mallei Through Genome Reduction and Large-Scale Rearrangements

Losada, Liliana; Ronning, Catherine M; DeShazer, David; Woods, Donald; Fedorova, Natalie; Kim, H S; Shabalina, Svetlana A; Pearson, Talima R; Brinkac, Lauren; Tan, Patrick; Nandi, Tannistha; Crabtree, Jonathan; Badger, Jonathan; Beckstrom-Sternberg, Steve; Saqib, Muhammad; Schutzer, Steven E; Keim, Paul; Nierman, William C; Jan 22, 2010; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519555; TR-09-131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Burkholderia mallei (Bm), the causative agent of the predominately equine disease glanders, is a genetically uniform species that is very closely related to the much more diverse species Burkholderia pseudomallei (Bp), an opportunistic human pathogen and the primary cause of melioidosis. To gain insight into the relative lack of genetic diversity within Bm, we performed whole-genome comparative analysis of seven Bm strains and contrasted these with eight Bp strains. The Bm core genome (shared by all seven strains) is smaller in size than that of Bp, but the inverse is true for the variable gene sets that are distributed across strains. Interestingly, the biological roles of the Bm variable gene sets are much more homogeneous than those of Bp. The Bm variable genes are found mostly in contiguous regions flanked by insertion sequence (IS) elements, which appear to mediate excision and subsequent elimination of groups of genes that are under reduced selection in the mammalian host. The analysis suggests that the Bm genome continues to evolve through random IS-mediated recombination events, and differences in gene content may contribute to differences in virulence observed among Bm strains. The results are consistent with the view that Bm recently evolved from a single strain of Bp upon introduction into an animal host followed by expansion of IS elements, prophage elimination, and genome rearrangements and reduction mediated by homologous recombination across IS elements.

DTIC

Bacteria; Genome; Virulence

20100019970 Northwestern Univ., Chicago, IL USA

Ebola Virus Uses Clathrin-Mediated Endocytosis as an Entry Pathway

Bhattacharyya, Suchita; Warfield, Kelly L; Ruthel, Gordon; Bavari, Sina; Aman, M J; Hope, Thomas J; Jan 2010; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519557; TR-06-096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ebola virus (EBOV) infects several cell types and while viral entry is known to be pH-dependent, the exact entry pathway(s) remains unknown. To gain insights into EBOV entry, the role of several inhibitors of clathrin-mediated endocytosis in blocking infection mediated by HIV pseudotyped with the EBOV envelope glycoprotein (EbGP) was examined. Wild type HIV and envelope-minus HIV pseudotyped with vesicular stomatitis virus glycoprotein (VSVg) were used as controls to assess cell viability after inhibiting clathrin pathway. Inhibition of clathrin pathway using dominant-negative Eps15, siRNA-mediated knockdown of clathrin heavy chain, chlorpromazine and sucrose blocked EbGP pseudotyped HIV infection. Also, both chlorpromazine and Bafilomycin A1 inhibited entry of infectious EBOV. Sensitivity of EbGP pseudotyped HIV as well as infectious EBOV to inhibitors of clathrin suggests that EBOV uses clathrin-mediated endocytosis as an entry pathway.

Furthermore, since chlorpromazine inhibits EBOV infection, novel therapeutic modalities could be designed based on this lead compound.
DTIC
Chlorpromazine; Proteins; Ribonucleic Acids; Viruses

20100019972 Ordway Research Inst., Albany, NY USA
Pharmacokinetic-Pharmacodynamic Assessment of Faropenem in a Lethal Murine Bacillus anthracis Inhalation Postexposure Prophylaxis Model
Gill, Stanley C; Rubino, Christopher M; Bassett, Jennifer; Miller, Lynda; Ambrose, Paul G; Bhavnani, Sujata M; Beaudry, Amber; Li, Jinfang; Stone, Kimberly C; Critchley, Ian; Janjic, Nebojsa; Heine, Henry S; May 2010; 7 pp.; In English
Report No.(s): AD-A519565; TR-08-057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There are few options for prophylaxis after exposure to Bacillus anthracis, especially in children and women of childbearing potential. Faropenem is a -lactam in the penem subclass that is being developed as an oral prodrug, faropenem medoxomil, for the treatment of respiratory tract infections. Faropenem was shown to have in vitro activity against B. anthracis strains that variably express the bla1 -lactamase (MIC range, 0.06 to 1 micrograms/ml). In this study we evaluated the pharmacokinetic-pharmacodynamic (PK-PD) relationships between the plasma faropenem free-drug (f) concentrations and efficacy against B. anthracis in a murine postexposure prophylaxis inhalation model. The plasma PKs and PKs-PDs of faropenem were evaluated in BALB/c mice following the intraperitoneal (i.p.) administration of doses ranging from 2.5 to 160 mg/kg of body weight. For the evaluation of efficacy, mice received by inhalation aerosol doses of B. anthracis (Ames strain; faropenem MIC, 0.06 g/ml) at 100 times the 50% lethal dose. The faropenem dosing regimens (10, 20, 40, and 80 mg/kg/day) were administered i.p. at 24 h postchallenge at 4-, 6-, and 12-h intervals for 14 days. The sigmoid maximum-threshold-of-efficacy (Emax) model fit the survival data, in which the free-drug area under the concentration-time curve (fAUC)/MIC ratio, the maximum concentration of free drug in plasma (fCmax)/MIC ratio, and the cumulative percentage of a 24-h period that the free-drug concentration exceeds the MIC under steady-state pharmacokinetic conditions (f %TMIC) were each evaluated. Assessment of f %TMIC demonstrated the strongest correlation with survival (R2 0.967) compared to the correlations achieved by assessment of fAUC/MIC or fCmax/MIC, for which minimal correlations were observed. The 50% effective dose (ED50), ED90, and ED99 corresponded to f %TMIC values of 10.6, 13.4, and 16.4%
DTIC
Bacillus; Bacteria; Dosage; Infectious Diseases; Lethality; Pharmacology; Prophylaxis; Respiration; Respiratory Diseases; Rodents

20100019975 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
CpG oligodeoxyribonucleotides protect mice from Burholderia pseudomallei but not Francisella tularensis Schu 54 aersols
Rozak, David A; Gelhaus, Herbert C; Smith, Mark; Zadeh, Mojgan; Huzella, Louis; Waag, David; Adamovicz, Jeffrey J; Jan 2010; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519570; TR-09-023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Studies have shown that CpG oligodeoxyribonucleotides (ODN) protect mice from various bacterial pathogens, including Burkholderia pseudomallei and Francisella tularensis live vaccine strain (LVS), when administered before parenteral challenge. Given the potential to develop CpG ODN as a pre-treatment for multiple bacterial biological warfare agents, we examined survival, histopathology, and cytokine data from CpG ODN-treated C57BL/6 mice to determine whether previously reported protection extended to aerosolized B. pseudomallei 1026b and highly virulent F. tularensis Schu S4 infections. We found that, although CpG ODN protected mice from aerosolized B. pseudomallei challenges, the immunostimulant failed to benefit the animals exposed to F. tularensis Schu S4 aerosols. Our results, which contrast with earlier F. tularensis LVS studies, highlight potential differences in Francisella species pathogenesis and underscore the need to evaluate immunotherapies against human pathogenic species.
DTIC
Mice; Microorganisms; Oligomers; Pathogens

20100019986 Agency for International Development, Washington, DC USA
Lantos-Hyde USA Government Malaria Strategy, 2009-2014
Apr 25, 2010; 20 pp.; In English
Report No.(s): AD-A519599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Malaria prevention and control is a major U.S. foreign assistance objective and is a core component of a comprehensive

U.S. Government (USG) Global Health Initiative (GHI), announced in May 2009 by President Barack Obama to reduce the burden of disease and strengthen communities around the world. The 2008 Tom Lantos and Henry J. Hyde Global Leadership against HIV/AIDS, Tuberculosis, and Malaria Act (Lantos/Hyde Act) authorizes up to $5 billion in USG funding for malaria prevention and control for the period FY2009-2013. This Act calls for the development of a comprehensive, multiyear USG strategy to combat malaria globally and strengthen the capacity of the USA to be an effective leader of international efforts to reduce the burden of malaria. For the purposes of planning, the proposed Lantos-Hyde USA Government Malaria Strategy (USG Malaria Strategy) reflects a six-year horizon (2009-2014) consistent with the duration of the Global Health Initiative. The Strategic Vision is that the USA will continue to provide global leadership in reducing preventable malaria deaths to near zero by 2015 and strive toward the ultimate goal of eradication. As part of the GHI, the USG Malaria Strategy for 2009-2014 proposes an expanded approach to USG-supported malaria control efforts directed at the following: Achieving Africa-wide impact by halving the burden of malaria (morbidity and mortality) in 70 percent of at-risk populations in sub-Saharan Africa; Limiting the spread of antimalarial multi-drug resistance in Southeast Asia and the Americas; Increasing emphasis on strategic integration of malaria prevention and treatment activities with maternal and child health, HIV/AIDS, neglected tropical diseases, and tuberculosis; Intensifying efforts to strengthen health systems; Assisting host countries to revise and update their National Malaria Control Strategies and Plans; and Ensuring a woman-centered approach for malaria prevention and treatment.

DTIC

Diseases; Medical Services; Parasitic Diseases; Prevention; Public Health; United States

20100019992 Naval Health Research Center, San Diego, CA USA

Women's Smoking History Prior to Entering the US Navy: A Prospective Predictor of Performance

Conway, Terry L; Woodruff, Susan I; Hervig, Linda K; Jan 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0203

Report No.(s): AD-A519628; NHRC-06-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this study is to examine whether women's tobacco use prior to entering the U.S. Navy is predictive of subsequent career performance. A priori predictions were that smoking at entry into the Navy would be related to early attrition, poorer job performance, more disciplinary problems, and lower likelihood of reenlistment. A prospective cohort analysis of 5,487 women entering the U.S. Navy between March 1996 and March 1997 was conducted. Navy attrition/retention and career performance measures, such as time in service, early attrition, type of discharge, misconduct, number of promotions, demotions and unauthorized absences, highest pay grade achieved, and re-enlistment were examined. Results showed that, compared with never smokers, daily smokers at entry into the U.S. Navy had subsequent career outcomes consistently indicating poorer job performance (e.g., early attrition prior to serving a full-term enlistment, more likely to have a less-than-honorable discharge, more demotions and desertions, lower achieved pay grade, and less likely to re-enlist). Other types of smokers consistently fell between never and daily smokers on career outcome measures. The authors conclude that, for women entering the U.S. Navy, being a daily smoker is a prospective predictor of poorer performance in the Navy. Future research should evaluate the effectiveness of cessation intervention with smoker-enlistees prior to their entering the Navy to assess the impact on subsequent career outcomes.

DTIC

Females; Military Personnel; Navy; Occupation; Physiological Factors; Smoke; Tobacco

20100019994 Naval Health Research Center, San Diego, CA USA

Smallpox Vaccination is Not Associated with Infertility in a Healthy Young Adult Population

Jacobson, Isabel G; Gumbs, Gia R; Sevick, Carter J; Smith, Tyler C; Ryan, Margaret A; Jun 2008; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519633; NHRC-07-27; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Concerns exist regarding reproductive health, including potential infertility, among young adults with military-related occupational exposures. This study evaluated infertility diagnoses in a large population of healthy young adults in relation to prior smallpox vaccination. Using a retrospective cohort design, the population consisted of USA military members eligible for smallpox vaccination in 2003-2004 who had electronic health care utilization records available through at least December 2005. Multivariable logistic regression models were applied to evaluate infertility among male and female populations separately. Among 253,973 men and 44,332 women included in these analyses, the adjusted odds of infertility diagnoses in those with prior smallpox vaccination were 0.94 [95% confidence interval (CI), 0.83-1.06] and 1.10 (95% CI, 0.94-1.28), respectively. Therefore, no association was found between smallpox vaccination and subsequent infertility diagnoses in either

men or women. This study represents the first large epidemiologic investigation of infertility after the smallpox vaccine.
DTIC
Adults; Epidemiology; Females; Fertility; Immunology; Males; Military Personnel; Populations; Smallpox; Viruses

20100019995 Naval Health Research Center, San Diego, CA USA
Postdeployment Hospitalizations among Service Members Deployed in Support of the Operations in Iraq and Afghanistan
Smith, Tyler C; LeardMann, Cynthia A; Smith, Besa; Jacobson, Isabel G; Ryan, Margaret A; Sep 2009; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519634; NHRC-07-26; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is significant concern by the public and military veterans over the impact of military deployments to Iraq and Afghanistan on veterans' health. This study investigates morbidity among military personnel who have been deployed by uniquely comparing after-deployment hospitalizations to before-deployment hospitalizations and hospitalizations among nondeployers. To compare after-deployment with before-deployment rates of morbidity, we examined active-duty military personnel who deployed for the first time in support of the current conflicts in 2003 or 2004 and had at least 12 months of service before deployment. We also compared the after-deployment hospitalizations to hospitalizations of personnel serving on active duty from May 2002 through May 2004 without a deployment from September 2001 through August 2006. This historical prospective investigation utilized Cox's proportional hazards time-to-event modeling. Hospitalizations for any cause and hospitalizations based on 14 broad diagnostic categories were examined. After adjusting for demographic and occupational variables, the after-deployment risk for any-cause hospitalization was greater in comparison with before-deployment (hazard ratio, 1.57; 95% CI, 1.48-1.66) but lower in comparison with nondeployers (HR, 0.95, 95% CI, 0.92-0.98). The authors conclude that active-duty service members have an increased risk of hospitalization after deployment compared with before deployment, but a lower risk when compared with nondeployers.
DTIC
Afghanistan; Deployment; Health; Iraq; Military Personnel

20100019996 Naval Health Research Center, San Diego, CA USA
Haemangiomas and Associated Congenital Malformations in a Large Population-Based Sample of Infants
Bukowinski, Anna T; Ryan, Margaret A; Slymen, Donald J; Sevick, Carter J; Alcaraz, John E; Smith, Tyler C; Jan 2008; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519635; NHRC-07-37; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Haemangiomas are common, benign, vascular tumors, observed in 4-12 percent of infants during the first year of life. Most cases progress without complication, yet a small proportion experience life-threatening complications. Concomitant congenital malformations have been reported in a small but significant proportion of haemangioma patients. This study aimed to describe haemangioma cases and to identify patterns of congenital malformations associated with these diagnoses in a large population. Diagnoses of haemangiomas and 21 congenital malformations were extracted from electronic medical records of 467,295 singleton infants born to U.S. military families from 1998 to 2003. Cluster analysis was used to group cases according to these diagnoses. Multivariable logistic regression was used to further explore the associations of the 21 congenital malformations with the diagnosis of haemangioma and to assess the adjusted relationships between a number of characteristics of interest and haemangioma diagnosis. Clusters found to be associated with haemangioma diagnosis were characterized by anomalies of the cervix, vagina, and external female genitalia, anophthalmia or microphthalmia, hydrocephalus without spina bifida, and reduction deformities of the brain. Logistic regression identified three congenital malformations significantly associated with haemangioma diagnosis: spina bifida without anencephalus, hydrocephalus without spina bifida, and anomalies of the cervix, vagina, and external female genitalia. Characteristics significantly associated with haemangioma diagnosis included female gender, preterm birth, white non-Hispanic race/ethnicity, and being born to an older mother. This exploratory study identified a number of important associations between haemangiomas and congenital malformations that may provide insight into the pathogenesis of these disorders and have possible implications for clinical care.
DTIC
Congenital Anomalies; Epidemiology; Military Personnel; Neoplasms; Populations

20100020000 Cold Spring Harbor Lab., New York, NY USA

A microRNA Cluster as a Potential Breast Cancer Oncogene

Hannon, Gregory J; Jan 2009; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0270

Report No.(s): AD-A519641; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To date, most cancer research has focused on alterations in the sequence, gene structure, copy number and expression of protein coding genes. However, there are increasing studies discovered that a diversity of non-coding RNAs decoded in the genome also plays an essential role in cancer. MicroRNAs (miRNAs), which are small, 21-24nt RNAs generated by the key enzyme Dicer, represent a prominent class of such non-coding RNAs. It has been reported that some miRNAs act as oncogenes to promote tumor formation in collaboration with protein-coding oncogenes. On the other hand, several miRNAs are found to function as tumor suppressors. Our previous study revealed a miRNA family, miR-34, as direct transcriptional target of p53, the master tumor suppressor gene. To address the role of miR-34 in cancer formation and maintenance, we generated cell lines overexpressing miR-34. We have demonstrated that ectopic expression of miR-34 in both primary and tumor cell lines can induce growth arrest through repression of cell cycle genes, and we have shown in animal models that tumor cells over expressing miR-34 have disadvantage in tumor initiation and maintenance. Our work placed miRNAs as one of the central mediators of p53 tumor suppressor network, which plays an important role in many cancer types, including breast cancer.
DTIC

Breast; Cancer; Carcinogens; Mammary Glands; Medical Science; Oncogenes; Ribonucleic Acids; Tumors; Viruses

20100020001 Rhode Island Hospital, Providence, RI USA

Assessment of GPR30, a Seven Transmembrane-spanning Estrogen Receptor, as an Oncogene

Filardo, Edward J; Oct 2009; 6 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0688

Report No.(s): AD-A519643; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Expression of the seven transmembrane-spanning receptor (7TMR), GPR30, in primary human breast tumors is positively associated with several tumor progression variables including extra mammary metastases (Filardo et al, 2006). Altered expression of 7TMRs is linked with a spectrum of disease phenotypes, including cancer, raising the possibility that GPR30 may function as an oncogene. Prior attempts to construct transgenic mice capable of expressing (HA-GPR30) transgenes under the transcriptional control of the mouse mammary tumor virus (MMTV) promoter failed. A second no cost extension was requested to construct mice with an HA-GPR30 transgene regulated by the whey acidic protein(WAP) promoter. These mice have recently been constructed and their genotypic and phenotypic analysis is underway.
DTIC

Breast; Cancer; Estrogens; Mammary Glands; Oncogenes

20100020007 L-3 Communications Corp., San Diego, CA USA

Mathematical Modeling of Physical and Cognitive Performance Decrement from Mechanical and Inhalation Insults

Stuhmiller, James H; Dec 2009; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-C-0051

Report No.(s): AD-A519657; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes specific accomplishments of Task Area K: Injury and Physiological Response to Blast, Blunt Trauma, and Inhaled Toxic Gases. Advances in mathematical modeling of injury and acute physiological response are described. Animal studies to determine critical model parameters and to collect data for validation of mathematical models are described. Advances in test instruments are also addressed. The report covers research conducted directly for the Military Operational Medicine Research Program and in collaboration with other civilian and military agencies.
DTIC

Injuries; Mathematical Models; Mental Performance; Overpressure; Performance Prediction; Respiration; Toxicology

20100020013 Army Medical Command, Fort Sam Houston, TX USA

Operation Iraqi Freedom 06-08

Feb 14, 2008; 111 pp.; In English

Report No.(s): AD-A519676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Mental Health Advisory Team (MHAT) was established by the Office of the U.S. Army Surgeon General at the request of the Commanding General, Multi-National Force-Iraq (MNF-I). The mission of MHAT V was to: 1. Assess Soldier

mental health and well-being 2. Examine the delivery of behavioral health care in Operation Iraqi Freedom (OIF) 3. Provide recommendations for sustainment and improvement to command. In the period of 2 SEP to 23 OCT, 2,279 OIF Soldiers completed an anonymous survey. In addition, 350 anonymous surveys were completed by behavioral health, primary care and unit ministry team members. During the period of 15 OCT to 15 NOV the MHAT V team (a) processed and analyzed survey data, (b) examined secondary data sources, and (c) conducted focus group interviews with Soldiers, behavioral health personnel, and medical personnel. The MHAT V team report and recommendations are based on these data sources. Section 2 is the Executive Summary. Partial contents of this report consist of Sections 3-16 focusing on the following areas: Background and Limitations; Overview of Soldier Well-Being; Soldier Behavioral Health and Performance Indices; Soldier Risk Factors; Soldier Protective Factors; Soldier Focus Groups; Behavioral Health Care System Assessment; Primary Care Survey; Unit Ministry Team Survey; Military Transition Teams Mental Health and Well-Being; Soldiers Stationed in Kuwait; Theater Suicide and Suicide Prevention.
DTIC
Medical Services; Mental Health; Military Personnel

20100020015 California Univ., San Francisco, CA USA
Engineering Anti-EGFR Antibodies for Treatment of Breast Cancers with Poor Prognosis
Marks, James D; Zhou, Yu; Sep 2009; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-07-1-0499
Report No.(s): AD-A519679; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To enhance in vivo efficacy of anti-EGFR full length IgG for treatment of basal breast cancers, the most aggressive subtypes, we have successfully employed molecular evolution approach to improve Fc binding affinity to Fc receptor that activates ADCC effect in our 2008 report. In the current report, we focus on the molecular evolution of Fc binding affinity to neonatal Fc receptor (FcRn), which modulates the half-life of IgG in vivo. In detail, we first expressed and purified soluble human FcRn in mammalian CHO expression system, then used human FcRn to select yeast-displayed library of Fc domain variants with random mutations. Several Fc domain variants were identified to bind human FcRn with enhanced affinity than wild-type Fc. We also found that by alternating FcRn and Fc gamma RIIIa/V158 in sorting, some variants exhibited higher binding affinity to both human FcRn and Fc gamma RIIIa/V158, which was not observed in previous studies improving the affinity to FcRn while losing the binding to Fc gamma RIIIa/V158. The Fc variants with improved affinity to both FcRn and Fc gamma RIIIa/V158 may show enhanced ADCC and prolonged half-life in vivo.
DTIC
Antibodies; Breast; Cancer; Mammary Glands; Prognosis

20100020016 Naval Academy, Annapolis, MD USA
Molecular Modeling Studies of Fluorinated Peptide and Amino Acid Analogs
Urban, Joseph; Jan 2007; 3 pp.; In English
Report No.(s): AD-A519680; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The specific aims of this work are the study of fluorinated peptide mimetics and fluorinated amino acids. NARC funding in the amount of 12.5 days was provided in support of this work during the Summer of 2007. This time was roughly equally divided between continuing work on the hydrogen bonded dimer complexes of fluoroalkene model compounds (fluoroethylene and 2- fluoro-2-butene) and beginning preliminary studies of fluorinated and hydroxylated amides as models for peptidomimetics. The details of these studies and how they fit into the larger context of the entire research program can be found in the detailed proposal (Enclosure (1)). A synopsis of the key results found during the support time is presented below.
DTIC
Amino Acids; Fluorination; Molecules; Peptides

20100020019 Army Medical Command, Fort Sam Houston, TX USA
Operation Iraqi Freedom 06-08: Iraq. Operation Enduring Freedom 8: Afghanistan
Feb 14, 2008; 224 pp.; In English
Report No.(s): AD-A519692; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The fifth Mental Health Advisory Team (MHAT) was established by the Office of the U.S. Army Surgeon General. Historically, teams have been formed to support requests from the Commanding General, Multi-National Force-Iraq (MNF-I); however, for MHAT V the request from MNFI-I was augmented by a request from the Service Chief, Army Central Command (ARCENT) to examine Soldiers in Afghanistan and Kuwait. The current MHAT report contains two separate reports - one for

Operation Iraqi Freedom (OIF) which includes a section on Soldiers in Kuwait, and one for Operation Enduring Freedom (OEF).The mission of MHAT V was to: 1. Assess Soldier mental health and well-being 2. Examine the delivery of behavioral health care in Operation Iraqi Freedom (OIF) 3. Provide recommendations for sustainment and improvement to command. Both of the reports have executive summaries providing key findings and recommendations specific to OIF and OEF. Partial contents of these reports include the following topics: Morale, Mental Health, Performance and Ethical Behavior; Sustainment of Soldier Resilience; Strengthening Families; Behavioral Health Care in Theater; Increase in the Number of Behavioral Health Personnel; Soldier Behavioral Health and Performance Indices; Soldier Risk Factors; Soldier Protective Factors; Soldier Focus Groups; Behavioral Health Care System Assessment; Primary Care Survey; Unit Ministry Team Survey; Military Transition Teams Mental Health and Welfare; Soldiers Stationed in Kuwait; Theater Suicide and Suicide Prevention. DTIC

Afghanistan; Iraq; Medical Services; Mental Health; Military Personnel

20100020021 Texas Univ., Houston, TX USA

The Regulation of JAB1 and Its Role in Breast Cancer

Johnson, Terry J; Mar 2008; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0330

Report No.(s): AD-A519695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the research done has been to determine the mechanism for overexpression of JAB1 through transcription factor analysis and FISH as well as the role of JAB1 in Herceptin resistance. The major findings thus far are 1) The promoter region of JAB1 key transcription factors were identified that may drive JAB1 expression, C/EBP alpha, C/EBP beta, and STAT3. We found that STAT3 together with C/EBP alpha and beta greatly increase JAB1 transcription. We have evidence that both STAT3 and C/EBP bind to the JAB1 promoter. Further, that SRC is one key upstream activator of JAB1 transcription. 2) We have performed FISH on a number of breast cancer cell lines and patient fine needle aspirations and have seen amplification of the JAB1 locus 3) JAB1 overexpression confers resistance to Herceptin in breast cancer cell lines SKBR3 and BT474, and inhibition of JAB1 increased the efficacy of Herceptin mediated G1 arrest and p27 accumulation. Additionally, JAB1 was found to correlate with Herceptin resistance in human breast cancer tissue samples. We have completed nearly all of the tasks listed for this time period and are on track as indicated in the SOW. DTIC

Breast; Cancer; Mammary Glands

20100020028 Michigan Univ., Ann Arbor, MI USA

The Influence of Physical Forces on Progenitor Cell Migration, Proliferation and Differentiation in Fracture Repair

Goldstein, Steven A; Hankenson, Kurt; Kilbourn, Michael; Nov 2007; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0107

Report No.(s): AD-A519722; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this program is to investigate the influence of controlled mechanical stimulation on the behavior of progenitor cells in an effort to develop strategies to significantly enhance the rate and quality of fracture repair in long bone. Progress in the program has been excellent. The results to date demonstrate the application of load increases the callus volume, bone mineral density and biomechanical properties. Early results also show that the The goal of this program is to investigate the influence of controlled mechanical stimulation on the behavior of progenitor cells in an effort to applied load may increase migration of systemically delivered progenitor cells to the repair site, but their role in repair may be more related to up regulating the repair, and not participation as differentiated repair cells. The results demonstrate the promise of load stimulation for enhancing fracture repair. DTIC

Bones; Cells (Biology); Fractures (Materials); Fracturing; Healing; Migration; Regeneration (Physiology)

20100020227 Pittsburgh Univ., Pittsburgh, PA USA

Revolutionizing Prosthetics

Schwartz, Andrew; Nov 5, 2009; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0053

Report No.(s): AD-A519507; 7620AA; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Brain activity was recorded with microelectrode arrays permanently implanted in the cerebral cortices of rhesus monkeys, The recorded activity was extracted in real time and used to control an anthropomorphic robotic arm. In the initial task, the

monkey used this arm to reach out and grasp a piece of food and return it to its mouth by operating a simple gripper at the end of the arm. More recently another monkey is operating the arm in a doorknob task with the goal of reaching, grasping, twisting and pulling. The arm is now outfitted with a 4DOFarm, a 3DOF wrist and a 4DOF hand. We have developed algorithms to extract wrist orientation, trained the subject to perform hand orientation using brain control and the newly-installed wrist and demonstrated this in the task.
DTIC
Prosthetic Devices; Robot Arms; End Effectors; Cerebrum; Real Time Operation

20100020259 David Grant USAF Medical Center, Travis AFB, Fairfield, CA USA
Comparative Testing of New Hemostatic Agents in a Swine Model of Extremity Arterial and Venous Hemorrhage
Clay, Jared G.; Grayson, J. Kevin; Zierold, Dustin; Military Medicine Journal; Jan 2010; Volume 175, No. 4, pp. 280-284; In English; 55th Annual Society of Air Force Clinical Surgeons Symposium. Partnerships for Surgical Success: Synergy in Militaty, Rural, and Metropolitan Practice, 5-9 Apr. 2009, Denver, CO, USA
Contract(s)/Grant(s): FDG200-08-0-002A
Report No.(s): AD-A518925; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518925

To compare advanced hemostatic dressings: HemCon (HC). QuikClot ACS+ (advanced clotting sponge, and two granular agents: Celox (CX) and WoundStat (WS), with a standard field dressing in a swine model of extremity hemorrhage. We randomized 30 animals to treatment with a standard dressing or a hemostatic agent applied to a 2 x 6-mm injury in the femoral artery and vein after 45 s of free bleeding. Animals received 500 mL. Hextend 15 min after the bleeding commenced without further resuscitation. End point was survival to 120 min or nonsurvivable blood pressure. Survival to 120 min among treatment groups was 100% (WS), 83% (CX). 67% (HC), and 50% (ACS+). No control animals survived. Post injury blood loss (mL/kg) was 4.6 (WS), 12.9 (CX). 10.0 (HC), and 15.8 (ACS+) compared to 27.0 for controls. All hemostatic dressings result in significantly less blood loss and improved survival over standard gauze dressing.
DTIC
Animals; Arteries; Hemorrhages; Swine

20100020283 Sitek Research Labs., Rockville, MD USA
Test for Chemical Induction of Chromosome Aberrations in Cultured Chinese Hamster Ovary (CHO) Cells With and Without Metabolic Activation. Test Article: Dimethylamine-2-2ethyl azide (DMAZ)
Song, Jian; July 26, 2008; 69 pp.; In English
Contract(s)/Grant(s): W91ZLK-07-P-1646
Report No.(s): AD-A519553; SITEK-SN-0976-3110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Dimethylamine-2-2ethyl azide (DMAZ, 99.3% pure) was tested for its potentials to induce chromosome aberrations in cultured Chinese Hamster Ovary (CHO) cells with and without metabolic activation according to OECD TG 473 in compliance with Good Laboratory Practice. DMAZ was evaluated at concentrations of 10, 50, 100, 500, 1000, 2500, and 5000 microg/mL in both with and without activation and was found negative for clastogenic potential. A confirmatory chromosome aberration assay was performed without activation also showed negative.
DTIC
Aberration; Amines; Azides (Inorganic); Azides (Organic); China; Chromosome Aberrations; Chromosomes; Hamsters; Metabolism; Methyl Compounds; Ovaries

20100020289 Sitek Research Labs., Rockville, MD USA
Evaluation of a Test Article in the Salmonella typhimurium/Escherichia coli Plate Incorporation Mutation Assay in the Presence and Absence of Induced Rat Liver S-9. Test Article: N,N,N',N'-tetramethyl ethanediamine (TMEDA)
Kirby, Paul E.; June 12, 2008; 78 pp.; In English
Contract(s)/Grant(s): W91ZLK-07-P-1646
Report No.(s): AD-A519620; SITEK-0977-2140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

N,N,N',N'-tetramethyl ethanediamine (TMEDA, 99.86% pure) was tested for mutagenic potentials with Salmonella typhimurium strains, TA 98, TA 100, TA 1535, TA 1537 and Escherichia coli strain WP2 uvrA by plate incorporation method according to OECD TG 471 in compliance with Good Laboratory Practice. TMEDA was tested at concentrations of 500, 750, 1,000, 3,000 and 5,000 g/plate for salmonella strains and Escherichia coli without and with activation. The results showed that TMEDA was not mutagenic in these strains both with and without activation. The result of confirmatory mutation assay with

and without activation also showed negative response. TMEDA was negative in the Salmonella typhimurium/Escherichia coli plate incorporation mutation assay both with and without activation.
DTIC
Assaying; Escherichia; Liver; Mutations; Rats; Salmonella

20100020303 Sitek Research Labs., Rockville, MD USA
Test for Chemical Induction of Chromosome Aberration in Cultured Chinese Hamster Ovary (CHO) Cells With and Without Metabolic Activation. Test Article: N,N,N',N'-tetramethyl Ethanediamine (TMEDA)
Song, Jian; June 13, 2008; 73 pp.; In English
Contract(s)/Grant(s): NO.0977-3110
Report No.(s): AD-A519474; SITEK-0977-3110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

N,N,N',N'-tetramethyl ethanediamine (TMEDA, 99.86% pure) was tested for its potentials to induce chromosome aberrations in cultured Chinese Hamster Ovary (CHO) cells with and without metabolic activation according to OECD TG 473 in compliance with Good Laboratory Practice. TMEDA was tested at concentrations of 500, 1000, 2500 and 5000 micrograms/mL in both with and without activation. It produced a positive response in this system with or without metabolic activation, but only at the highest concentration 5,000 micrograms/mL However, according to the OECD guidelines TG 473, the compound is considered to be negative in the CHO chromosomal aberration assay, since the compound is not clastogenic at 0.01M (1,140 micrograms/mL). A confirmatory chromosome aberration assay was performed without activation also showed negative at concentrations up to 3,000 micrograms/mL but positive at the highest concentration.
DTIC
Aberration; China; Chromosomes; Hamsters; Metabolism; Ovaries

20100020308 Sitek Research Labs., Rockville, MD USA
In Vivo Test for Chemical Induction of Micronucleated Polychromatic Erythrocytes in Mouse Bone Marrow Cells. Test Article: N,N,N',N'-tetramethyl Ethanediamine (TMEDA)
Song, Jian; Shore, Karen S.; June 19, 2008; 66 pp.; In English
Contract(s)/Grant(s): W91ZLK-07-P-1646
Report No.(s): AD-A519471; 0977-1521; No Copyright; Avail.: Defense Technical Information Center (DTIC)

N,N,N(prime),N(prime)-tetramethyl ethanediamine (TMEDA, 99.86% pure) was tested for its potentials to induce micronucleated polychromatic erythrocytes (MPCE) in the bone marrow cells of male and female CD-1 mice according to OECD TG 474 in compliance with Good Laboratory Practice. Male and female mice were dosed orally at 62.5,125 and 250 mg/kg. Animals were euthanized approximately 24 and 48 hrs after dosing. The percent of polychromatic erythrocytes (PCE) and frequency of micronucleated polychromatic erythrocyte (MPCE) were determined at 24 and 48 hrs. Cytotoxicity was assessed by scoring the number of PCE and normochromatic erythrocyte (NCE) in first 200 erythrocytes for each animal. There were no statistically significant increases in the number of MPCE in the treated groups when compared to the concurrent vehicle control group. These results indicate that TMEDA was negative in the in vivo mouse micronucleus assay and the compound was not clastogenic.
DTIC
Bone Marrow; Cells (Biology); Erythrocytes; Ethylenediamine; In Vivo Methods and Tests; Mice

20100020319 Army Medical Surveillance Activity, Silver Spring, MD USA
Device-Specific Rates of Needlestick Injury at a Large Military Teaching Hospital
Nevin, Remington L.; Carbonell, Ivan; Thurmond, Veronica; January 2008; 4 pp.; In English
Report No.(s): AD-A519373; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The device-specific needlestick injury (NSI) rate is a method of quantifying risk of needle injury in terms of a denominator that accounts for inherent differences in exposure risks between populations under study. Device-specific NSI provides a means of comparing rates of injury between work sites and institutions over time. Rates quoted in the literature for various devices vary significantly, ranging from 0.9 to 67.7 NSI per 100,000 devices purchased or used(1-5) depending on context, although most studies find rates of approximately 10 NSI per 100,000 devices.
DTIC
Education; Hospitals; Injuries; Needles

20100020320 Naval Health Research Center, San Diego, CA USA

Prospective Analysis of Psychiatric Risk Factors in Marines Sent to War

Larson, Gerald E.; Booth-Kewley, Stephanie; Highfill-McRoy, Robyn M.; Young, Sylvia Y.; June 13, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519363; NHRC-07-36; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this longitudinal study was to identify risk factors for combat-related psychiatric disorders. The sample consisted of 6,442 enlisted U.S. Marines who completed a questionnaire during basic training, deployed to a combat zone with no prior psychiatric diagnoses, and completed a postdeployment assessment form. Cox proportional hazards regression was used to determine associations between predeployment and postdeployment self-reports and subsequent mental health outcomes. During the observation period, 6.8% of the sample were diagnosed with a psychiatric disorder. The strongest predictors of postdeployment psychiatric disorders were, in order of importance, low paygrade, hospitalization during deployment, low education, preservice smoking, and post-traumatic stress disorder symptoms at deployment's end. The impact of war zone variables was smaller than expected. It was recommended that the combat experience section of the military's postdeployment assessment form be expanded to enhance the military's ability to identify and refer personnel who may be at risk for psychiatric disorders.

DTIC

Disorders; Mental Health; Military Personnel; Risk; Warfare

20100020322 Army Medical Research and Materiel Command, Fort Detrick, MD USA

2009 Annual Report TATRC

January 2009; 218 pp.; In English

Report No.(s): AD-A519327; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Telemedicine & Advanced Technology Research Center (TATRC) performs medical research reconnaissance and special operations to address critical gaps that are underrepresented in other Department of Defense (DoD) medical research programs. TATRC is an office of the headquarters of the US Army Medical Research and Materiel Command (USAMRMC). The Center conducts research in specific key capability areas including health informatics, telemedicine/m-Health, and computational biology. TATRC is also responsible for promoting and managing national and international extramural research in other key areas, notably medical training systems, medical robotics, human performance enhancement technologies, medicine in austere environments, brain and behavior neurosciences, and tissue engineering technologies. Through an extensive network of partners and consultants, TATRC explores management models for innovation and technology transfer, and supports core medical research program augmentation opportunities provided by special types of funding such as congressional special interest, Small Business Innovation Research (SBIR) Program, Joint Incentive Funds (JIF), and through leveraging other federal partner programs. The focus is generally at both ends of the research spectrum, from supporting high-risk innovative research to placing those innovations into the hands of the Warfighter (i.e., transition to military applications and institutionalization of research products and findings).

DTIC

Medical Science; Medical Services; Military Operations; Organizations; Telemedicine

20100020350 NASA Marshall Space Flight Center, Huntsville, AL, USA

Enhanced Microbial Detection Capabilities by a Rapid Portable Instrument

Morris, Heather; Monaco, Lisa; Wainwright, Norm; Steele, Andrew; Damon, Michael; Schenk, Alison; Stimpson, Eric; Maule, Jake; Effinger, Michael; April 25, 2010; 2 pp.; In English; SpaceOps 2010: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Contract(s)/Grant(s): NNM05AB50C

Report No.(s): M09-0708; Copyright; Avail.: Other Sources; Abstract Only

We present data describing a progression of continuing technology development - from expanding the detection capabilities of the current PTS unit to re-outfitting the instrument with a protein microarray increasing the number of detectable compounds. To illustrate the adaptability of the cartridge format, on-orbit operations data from the ISS demonstrate the detection of the fungal cell wall compound beta-glucan using applicable LOCAD-PTS cartridges. LOCAD-PTS is a handheld device consisting of a spectrophotometer, an onboard pumping mechanism, and data storage capabilities. A suite of interchangeable cartridges lined with four distinct capillaries allow a hydrated sample to mix with necessary reagents in the channels before being pumped to the optical well for spectrophotometric analysis. The reagents housed in one type of cartridge trigger a reaction based on the Limulus Amebocyte Lysate (LAL) assay, which results in the release of paranitroaniline dye. The dye is measured using a 395 nm filter. The LAL assay detects the Gram-negative bacterial cell wall molecule, endotoxin

or lipopolysaccharide (LPS). The more dye released, the greater the concentration of endotoxin in the sample. Sampling, quantitative analysis, and data retrieval require less than 20 minutes. This is significantly faster than standard culture-based methods, which require at least a 24 hour incubation period.Using modified cartridges, we demonstrate the detection of Gram negative bacteria with protein microarray technology. Additionally, we provide data from multiple field tests where both standard and advanced PTS technologies were used. These tests investigate the transfer of target microbial molecules from one surface to another. Collectively, these data demonstrate that the new cartridges expand the number of compounds detected by LOCAD-PTS, while maintaining the rapid, in situ analysis characteristic of the instrument. The unit provides relevant data for verifying sterile sample collection protocols, which are critical for conducting accurate scientific experiments during future missions to the Moon and Mars.
Author
Detection; Microorganisms; Bacteria; Cells (Biology); Field Tests; Proteins; Adaptation; Fungi; Molecules; Spectrophotometry; Quantitative Analysis

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20100018384 NASA Johnson Space Center, Houston, TX, USA
Johnson Space Center Health and Medical Technical Authority
Fogarty, Jennifer A.; May 12, 2010; 17 pp.; In English; 81st Annual Scientific Meeting of the Aerospace Medical Association, 9-13 May 2010, Phoenix, AZ, USA
Report No.(s): JSC-CN-20399; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018384

1.HMTA responsibilities: a) Assure program/project compliance with Agency health and medical requirements at identified key decision points. b) Certify that programs/projects comply with Agency health and medical requirements prior to spaceflight missions. c) Assure technical excellence. 2. Designation of applicable NASA Centers for HMTA implementation and Chief Medical Officer (CMO) appointment. 3. Center CMO responsible for HMTA implementation for programs and projects at the center. JSC HMTA captured in 'JSC HMTA Implementation Plan'. 4. Establishes specifics of dissenting opinion process consistent with NASA procedural requirements.
Author
Space Exploration; Health; Space Flight; Systems Integration; Life Sciences; Posture; Risk

20100018426 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering, Volume 23, No. 1
Chen, Shan-guang, Editor; Wang, Xian-min, Editor; Bai, Jing, Editor; Bai, Yan-qiang, Editor; Sun, Xi--qing, Editor; Hong, Feng, Editor; Su, Hong-yu, Editor; Jiang, Shi-zong, Editor; February 2010; 84 pp.; In Chinese; See also 20100018427 - 20100018440; Original contains black and white illustrations
Report No.(s): CN 11-2774/R; Copyright; Avail.: Other Sources

Topics covered include: Effects of Exercise Training on Weight-Bearing Bone Loss during 30 d -6 deg Head-Down Bed Rest; Effects of Tail-Suspension, Noise and Combination of Two Stresses on Immune Function of Rats; Indirect Evaluation of Sarcoplasmic Reticulum Ca2+ Release Function in Skeletal Muscle Strips; Establishment of an Osteoblastic Model Reflecting Cbfa1 Activity with Fluorescent Intensity; Research on Comprehensive Assessment Method of Mental Fatigue in Monitoring Task; Expression of beta Defensin Genes in Rat Airway Epithelium after Intraperitoneal Injection of Emulsified Isoflurane; Activated Caspase-8 Regulates Bcl-2 Expression in Fas- and Actinomycin D-induced Apoptosis in Bel-7402 Cells; Research on Development of 'Psychological Stress Questionnaire of China Civil Aviation Pilots"; Emulating Analysis of the Temperature Field for Hyperthermia Treatment of Skin Diseases with Direct Heating; Effects of Hypobaric Environment on Growth and Physiological Characteristic of Lettuce; Optimization of RAPD Reaction System and Analysis of 'HANGQIE-5' Eggplant Generated by Space Mutagenesis; A Novel Quantitative Analysis Method Called Tessellated Map for

ECG Mapped Phase Space; Research of Automatic QT Interval Detection Based on Morphological Method; and Progress in Brain-Computer Interface Based on Cortical Evoked Potential.
Author
Aerospace Medicine; Bed Rest; Bone Demineralization; Electrocardiography; Mental Performance; Musculoskeletal System; Physical Exercise; Quantitative Analysis; Sarcoplasmic Reticulum; Skeletal Muscle

20100018427 Tianjin Univ., China
Research of Automatic QT Interval Detection Based on Morphological Method
Yu, Hui; Du, Fei; Zhang, Li-xin; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 63-68; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective To study and design a new algorithm of QT interval measurement based on multi-scale morphological derivative transform (MMDT) according to the demand of mobile monitoring platform. Methods After the MMDT of ECG signal by inducing a triangle and a short line as a pair of structure elements, they were classified into four type by their morphological characteristic and the optimal strategy for each type was described to detect the onset of Q-wave. By introducing the 'wing' function, two referenced points of T peak were picked out, which was helpful to locate the peak and offset of T wave, and improve the precision and recognition rate of MMDT method when detecting the bifid T wave (90. 9%) and biphasic T wave (86.7%). Results Eighty data records from CSE database were used to valuate the availability. By contrast with the wavelet transform method, the statitical result showed that the proposed algorithm had generally less error and smaller standard deviation especially for abnormal-phase T wave. Conclusion Compared with those algorithms based on wavelet transform and self-adaptive threshold technique, our algorithm need less empirical parameters and calculation. It is also suitable for mobile monitoring and HOLTER system, and has a wide prospect of application.
Author
Detection; Wavelet Analysis; Automatic Control; Morphology; Algorithms

20100018428 Institute of Space Medico-Engineering, Beijing, China
Research on Development of 'Psychological Stress Questionnaire of China Civil Aviation Pilots'
Zhao, Xiang; Xu, Bai-hua; Gao, Xiang; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 35-41; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective: To develop ' Psychological Stress Questionnaire of China Civil Aviation Pilot (PSQ-CCAP)' according to their vocational characteristic. Methods: Firstly based on literature reviews, expert interview and open questionnaire investigations, the preliminary psychological stress questionnaire , with 47 items, was developed. Preliminary test data (N1 = 144) were processed with factor analysis, reliability and validity detection. Secondly 180 questionnaires were sent to various airline civil aviation pilots, 165 were back. Formal test data (N2 = 315) were checked with factor analysis. Results: 'PSQ-CCAP' consisted of work load, colleague relation, career development, requirements of aviation safety, work environment and life event stresses, 6 dimensions, total with 32 items. Good reliability and validity (with c coefficient 0.706 to approx. 0.897) met the requirements of PSQ-CCAP. Concluson: 'PSQ-CCAP' is developed. It can be applied to psychological stress measurement of China civil aviation pilots and further related researches.
Author
Civil Aviation; Stress (Psychology); Reliability; Aircraft Pilots; Flight Safety; Airline Operations; Aircraft Safety

20100018429 China Astronaut Research and Training Center, Beijing, China
Effects of Hypobaric Environment on Growth and Physiological Characteristic of Lettuce
Liu, Yu-sheng; Wu, Bin; Fei, Jun; Tan, Cheng; Zhao, Dong-ming; Sun, Hong-yi; Gu, Zhi-ming; Wu, Ping; Liu, Xing-hua; Wang, Jun; Zhong, Chong-fa; Geng, Jie; Sun, Xi-qing; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 47-51; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To investigate the characteristic of growth and development of vegetable at hypobaric environment and offer the cultivating technique of controlled ecological life support system for higher plants. Methods: The means of comparative measurement was adopted to study the growth and physiological characteristic of lettuce under low and normal pressure (40.0 kPa, 101.0 kPa), which was carried out with the low pressure plant-cultivating facilily. Results: Compared wilh normal pressure, germination rate of lettuce seed was eliminated by 7.62% under total pressure 40.0 kPa and oxygen partial pressure 8.4 kPa condition; harvest time of lettuce was delayed, so biomass harvested at the same time reduced by 13.67% and content of total saccharide declined; the average rates of photosynthesis and transpiration were lower than those at normal pressure

in 30 days after planting (DAP), but which reversed after that; release of C2H4 and shoot height reduced by 38.79%. and 11.68%, but leaf area, ratio of root total biomass and root vigor increased by 15.43%, 2.57% and 40.53%, respectively. Conclusion: Seed germination, growth and development of lettuce are affected in some degree at total pressure 40.0 kPa and oxygen partial pressure 8.4 kPa, some measure should be adopted to regulate the growth of lettuce.
Author
Biomass; Vegetables; Planting; Partial Pressure; Germination; Low Pressure; Ecosystems; Environmental Tests

20100018430 China Astronaut Research and Training Center, Beijing, China
Research on Comprehensive Assessment Method of Mental Fatigue in Monitoring Task
Wang, Zheng; Li, Yan-jun; Yan, Qu; Wang, Hong-wei; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 20-24; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective: To study the relationship between eye movement, HRV indexes and mental fatigue, find feasible objective indexes and build the comprehensive method to evaluate mental fatigue. Methods: When twenty subjects executed the simulated monitoring task for 60 min, pupil diameter and ECG data were recorded by eye tracker system and Holter. The subjects were divided into 2 groups (fatigued group/scarcely fatigued group) according CFF (critical flicker frequency) and reaction time (RT). Based on comparison of various indexes between pre- and post-monitoring task, potent indexes were extracted to evaluate mental fatigue. Results: After monitoring task, the change of fatigue feeling, Perclos, r-MSSD, PNN50, HF, LF and TP were significantly different in two groups. Conclusion: It's suggested that psychology, Perclos and HRV indexes can be used to build the multilevel comprehensive method which can detect mental fatigue quantitatively and qualitatively.
Author
Electrocardiography; Psychology; Heart Rate; Critical Frequencies; Fatigue (Biology); Eye Movements

20100018431 Institute of Space Medico-Engineering, Beijing, China
Emulating Analysis of the Temperature Field for Hyperthermia Treatment of Skin Diseases with Direct Heating
Zhuo, Zi-han; Feng, Li; Wang, Xu-fei; Zhang, Xiao-dong; Tang, Jin-tian; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 42-46; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective To study temperature field distribution for hyperthermia of skin diseases with direct heating, and this helps develop experimental research. Methods In the condition skin be direct heated, we set up physical model of the skin and bio-heat transfer equation based on the structure of the skin and bio-heat transfer theories; simulated temperature field distribution in different situations by the method of finite differences. Results simulation result of both steady and dynamic temperature field distribution confirmed the possibility of curing skin diseases by heating it. Conclusion Our results will be useful for deeper research and use of hyperthermia of skin disease with accurate temperature control by direct contact heating.
Author
Diseases; Heat Transfer; Hyperthermia; Temperature Distribution; Skin (Anatomy)

20100018432 Institute of Space Medico-Engineering, Beijing, China
A Novel Quantitative Analysis Method Called Tessellated Map for ECG Mapped Phase Space
Li,Yan-jun; Yan, Hong; Wang, Zeng-li; Wang, Xiang-Lin; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 57-62; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective The traditional delay time phase space reconstruction method has the disadvantages of complicated operation, time consuming and unstableness. This paper presented a novel approach called Tessellated Map (TM) for ECG phase space quantitative analysis. Methods Firstly, 2-D matrix X with each ECG-cycle as a column vector was constructed. Secondly, the principal components of X based on KarhunenLoev Transform (KLT) were gotten to reconstruct X from the first eigenvector of XX(sup T). Then the high SNR ECG-cycle form X based on reconstruction error was selected, to construct the 2-D matrix Y. Afterwards, TM was gotten from united Y and Z (derived from the difference of Y). Three TM-based quantitalive indexes, consisted of ratio of blank zone, density of points and TM Bitmap (TMB) were gotten. Results This approach could differentiate mental stress from non-stress, estimate arrhythmia, and could be used for personal identification. Conclusion TM is a useful way to obtain information from ECG, and has its value for further research.
Author
Electrocardiography; Quantitative Analysis; Phase-Space Integral; Eigenvectors; Aerospace Medicine

20100018433 Sichuan Univ., Chengdu, China

Expression of Beta Defensin Genes in Rat Airway Epithelium after Intraperitoneal Injection of Emulsified Isoflurane

Luo, Lin; Deng, Lu-xia; Huang, Ning; Zhu, Tao; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 25-30; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To examine the expression of beta defensin genes and inflammatory cytokine genes in rat airway epithelium after intraperitoneal injection of emulsified isoflurane. Methods: Thirty-six SD rats were assigned into six groups (A-F) randomly. The tissue from rat airway epithelium were harvested at 1 h after intraperitoneal injection of normal saline, 30% fat milk and 8% emulsified isoflurane of 4 different dosage (0.25, 0.5, 1.0 and 1.5 times of ED(sub 50)). Then expressions of beta defensin (BD-1, BD-2), tumor necrosis factor-alpha (TNF-alpha), interleukin beta (IL-1beta), IL-8 mRNA were measured by semiquantitative polymerase chain reaction (PCR) using GAPDH as an internal standard. Results: Except BD-1 and IL-8 mRNA, marked increases in expression of TNF-alpha, IL-1beta and BD-2 genes were observed with a dosage-dependent manner. Conclusion: The expression of BD-2 genes and inflammatory cytokine genes (IL-1beta, TNF-alpha) in rat airway epithelium increases significantly in a dosage-dependent manner after intraperitoneal injection of emulsified isoflurane.
Author

Epithelium; Interleukins; Rats; Tumors; Dosage; Genes

20100018434 China Astronaut Research and Training Center, Beijing, China

Establishment of an Osteoblastic Model Reflecting Cbfa1 Activity with Fluorescent Intensity

Tong, Fei-fei; Dai, Zhong-quan; Guo, Fei-ma; Ding, Bai; Tan, Ying-jun; LV, Jin-yin; Li, Ying-hui; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 15-19; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To obtain MG63 cell lines which are stably transfected with enhanced green fluorescent protein (EGFP) reporter gene derived by 60SE2 promoter and select the cell strain which can reflect Cbfa1 activity by EGFP fluorescence. Methods: 60SE2 promoter was synthesized and cloned into pUC57-T vector. The 140 bp promoter fragment inserted into deleted CMV-promoter pEGFP-N1 vector to construct eukcaryotic expression vector. MG63 cell was transfected with this vector by Lipofectamine 2000 and stably selected by G4l8. Analysed the EGFP fluorescence intensity of the stably transfected MG63 cell strain and detection of ALP activity after treatment with different concentration of IGF-I or VD3, then selected one which could be reflecting Cbfal activity. Results: The pUC-60SE2 vector and p60SE2-EGFP expression vectors were constructed. Through stably transfection and selection, one OSE-MG63 cell strain was gained, which fluorescence intensity could reflect the treatment of IGF-I or VD3. Conclusion: The osteoblastic model which can reflect Cbfal activity is established successfully. This cell line will be useful for studying the effect of microgravity on the activity of Cbfal and the signal pathways related with bone form.
Author

Bones; Fluorescence; Gravitational Effects; Proteins

20100018435 China Astronaut Research and Training Center, Beijing, China

Effects of Exercise Training on Weight-Bearing Bone Loss during 30 d -6 deg Head-Down Bed Rest

Liu, Yu-sheng; Wu, Bin; Fei, Jun; Tan, Cheng; Zhao, Dong-ming; Sun, Hong-yi; Gu, Zhi-ming; Wu, Ping; Liu, Xing-hua; Wang, Jun; Zhong, Chong-fa; Geng, Jie; Sun, Xi-qing; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 1-5; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To observe the protective effect of the lower limb muscular strength exercise training and the bicycle ergometer exercise training method on weight-bearing bone loss during 30 d -6deg head-down bed rest (HDBR), and screening available exercise training method for space flight astronauts exposed to space microgravity. Methods: Fifteen men were divided into three groups, control group (A), lower limb muscular strength exercise training group (B) and bicycle ergonometer exercise training group (C), with 5 in each group. Both exercise groups were conducted 25 times exercise training during 30 d -6deg HDBR. B group was 16 - 18 min everyday, and C group 30 min. The exercise training was carried out in -6deg head down tilt supine position. Before and after 30 d -6deg HDBR, the whole body bone mineral density (BMD QDR4500/W Hologic), whole body bone mineral content (BMC), and lumbar pine trabecular ratio (CT Philip -Mx-8000) were measured. Results: Compared with pre-HDBR, in group : the left hip total BMD, the right hip trochanter BMD and the lumbar spine (2 approx. 4) trabecular ratio significantly decreased; in group C, even though whole body BMD increased significantly, the lumbar spine (3 - 4) BMD decrease significantly in group B, the whole body BMD and weight-bearing bone BMD did not decrease significantly. Conclusion: This study shows that the control group weight-bearing bone, i.e. lumbar spine and hip bone BMD

significant decreased during 30 d -6deg HDBR, the bicycle ergometer exercise training method even though whole body BMD increase significantly, but not maintain lumbar spine BMD during 30 d -6deg HDBR, however , the lower limb muscular strength exercise training method has significant protective effect on whole body and weight-bearing bone BMD during 30 d -6deg HDBR. These study results provide valuable basis in fomulating countermeasure protocol for space flight astronauts exposed to space microgravity.
Author
Body Weight; Bone Demineralization; Supine Position; Lumbar Region; Head Down Tilt; Physical Exercise; Muscular Strength; Bone Mineral Content

20100018436 Institute of Space Medico-Engineering, Beijing, China
Progress in Brain-Computer Interface Based on Cortical Evoked Potential
Zhao, Jun-bang; Zhang, Zhi-jun; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 74-78; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Brain-computer interface (BCI) was a communication system that did not depend on the brain's normal output pathways of the peripheral nerves and muscles. BCI provided a new communication channel for the patients with severe neuromuscular disorders, and also had potential value in virtual reality, entertainment and aviation. Recently, BCI developed rapidly, and its researchs mostly concentrated on feature extraction and translation algorithm. Cortical evoked potential such as steady-state visual evoked potential (EP) and P300 were widely applied in BCI because of simple feature extraction and requiring little training. The progress in SSVEP-based and P300-based BCI was reviewed, and its experimental paradigms and limitation were analyzed in this paper.
Author
Brain; Neuromuscular Transmission; Computer Systems Programs; Psychology

20100018437 Fourth Military Medical Univ., Xi'an, China
Indirect Evaluation of Sarcoplasmic Reticulum Ca2+ Release Function in Skeletal Muscle Strips
Sheng, Juan-Juan; Li, Quan; Yu, Zhi-bin; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 10-14; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To set up a simple method to measure the SR Ca2+ release function in skeletal muscle strips. Methods: The time from peak tension to 75 % relaxation (TR75) during intermittent tetanic contraction (fatigue contraction) of isolated musculus soleus strip was analyzed. It was prolonged rapidly, and then shortened slowly. The ratio of maximal TR75 to initial TR75 (R-TR75) indicated a balance between R Ca2+ release and uptake. If the SR Ca2+ -ATPase (SERCA) activity and inhibition extent of SERCA in fatigue contraction were identical, R-TR75 should be an index for SR Ca2+ release function. Results: Higher stimulation voltage or 5 mmol/L caffeine perfusion which increased the SR Ca2+ release channel open probability induced an increase of R-TR75 from 2.5 in control to 3.0. On the contrary, inhibition of SR Ca2+ release with 5 mmol/L magnesium sulfate perfusion significantly decreased R-TR75. Inhibition of SR Ca2+ release by metabolite during fatigue contraction was recovered slowly. So R-TR75 at the second fatigued contraction was reduced after 5 or 10 min of recovery, but no significant difference after 60 min of recovery. During intermittent tetanic contraction R-TR75 was increased to be 2.9 times of normal in unloaded soleus. Conclusion: The above results suggest that R-TR75 during muscle strip fatigue contraction without any change of SERCA activity can indirectly reflected SR Ca2 + release function. In 2-week unloaded soleus, the enhanced R-TR75 indicated an increase in R Ca2 + release function.
Author
Magnesium Sulfates; Muscular Function; Musculoskeletal System; Skeletal Muscle; Contraction; Diffusion; Muscles

20100018438 Institute of Space Medico-Engineering, Beijing, China
Optimization of RAPD Reaction System and Analysis of 'HANGQIE-5' Eggplant Generated by Space Mutagenesis
Ren, Chun-xiao; Liu, Min; Lu, Jin-ying; Wu, Yu-huan; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 52-56; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective: To analyze the new breeding of eggplant 'HANGQIE-5' (HQ-5) generated by pace mutagenes is with RAPD, identify the differential RAPD bands, and try to provide molecular proofs for space mutation breeding. Methods: Dry seeds of two eggplant 'Tianshuichangqie (TSCQ)' and Longguoyuanqie (LGYQ) were carried by 'shenzhou-4' and 'shenzhou-3' spaceship. Two mutant line 'TSCQ-MUT-4' and 'LGYQ-MUT-4' were selected after four generations of self-cross of TSCQ and LGYQ. A new variety of 'HQ-5' was selected by crossing the two lines of 'TSCQ-MUT-4' and 'LGYQ-MUT-4', which

were male and female, respectively. The RAPD reaction system was optimized with orthogonal design and further RAPD analysis was applied. Results: The RAPD reaction system was determined as follows: DNA: 40 ng, dNTPs: 7.5 nmol, primer: 10 ng, and rTaq polymerase ; 1.25 U. The RAPD results displayed that TSCQ-MUT-4 produced four differential bands compared with its wild type, while LGYQ-MUT-4 produced one, through space flight. Six differential fragments were amplified between HQ-5 and the paternal/maternal. HQ-5 not only shared the common fragment with its parents, but also held some particular ones, which were stably inherited. Conclusion: The results indicate that space mutations could cause mutations in DNA of plants, and is helpful to generate a new breeding.
Author
Mutagenesis; Breeding (Reproduction); Deoxyribonucleic Acid; Fragments; Proving; Seeds; Mutations; Crossings

20100018439 China Astronaut Research and Training Center, Beijing, China
Effects of Tail-Suspension, Noise and Combination of Two Stresses on Immune Function of Rats
Zhang, Hong-yu; Song, Jin-ping; Xiong, Jiang-hui; Qu, Li-na; Yang, Fen; Li, Ying-hui; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 6-9; In Chinese; See also 20100018426; Copyright; Avail.: Other Sources

Objective: To investigate the effect of tail-suspension, noise stress and combination of them on immune function in rats. Methods: The rats were divided into four different groups, A: control; B: noise stress (2 h); C: tail-suspension (30deg, 21 d); D: tail-suspension added noise stress. The body weight, thymus weight and spleen weight, circulating leukoytes and its distribution, T lymphocyte subpopulations (with flow cytometry) and NO level in serum (with Griess method) of rats were determined after exposed to 21 d tail-suspension, 2 h noise stress and combination of them. Results: Compared with group A, the body weights were significantly decreased ($P < 0.01$), the percent of lymphocytes were also reduced ($P < 0.05$), but the numbers and percents of circulating leukocytes, neutrophils were markedly increased ($P < 0.01$) in group C and D. T lymphocyte, Th subset (both $P < 0.05$) and Th/Tc ratio ($P < 0.01$) increased in group D. The NO level in serum was markedly reduced ($P < 0.01$) in B, C and D groups. Conclusion: Tail-suspension had significant effects on the body weight, circulating leukocyte and its distribution, NO level in serum of rats. Noise stress had synergistic effect with tail-suspension on lymphocyte subsets.
Author
Body Weight; Leukocytes; Neutrophils; Rats; Circulation

20100018440 Institute of Space Medico-Engineering, Beijing, China
Activated Caspase-8 Regulates Bcl-2 Expression in Fas- and Actinomycin D-Induced Apoptosis in Bel-7402 Cells
Wang, Lu; Wang, Yu; Xia, Chun-hui; Space Medicine and Medical Engineering, Volume 23, No. 1; February 2010, pp. 31-34; In Chinese; See also 20100018426; Original contains black and white illustrations; Copyright; Avail.: Other Sources

Objective: To investigate whether caspase-8 regulates Bcl-2 expression in Fas and Actinomycin D (AD) induced apoptosis in Bel-7402 cells. Methods: Bel-7402 cells were divided into four groups randomly, that is: control, Fas group, Fas-AD group and Ac-IEFD-cho group, and treated with Fas-D in the presence/absence of caspace-8 inhibitor Ac-IEFD-cho. The expressions of caspace-8 and Bcl-2 were determined with Western Blot and RT-PCR, respectively. Results: Compared with control group and Fas group, after Bel-7402 cell were treated with Fas-AD, typical apoptosis morphology, a clearly observed, the expression of activated caspase-8 increased significantly, and the Bcl-2 expression decreased apparently. However , after Bel-7402 cells were treated with Fas-AD in the presence of the caspace-8 inhibitor Ac-IEFD-cho, the expre ion of activated caspace-8 decreased while th Bcl-2 expression increased. Conclusion: Activated caspace-8 can regulat Bcl-2 in Fas- and AD-induced apoptosis in Bel-7402 cells.
Author
Apoptosis; Inhibitors; Enzymes; Actinomycin

20100018590 Wyle Integrated Science and Engineering Group, Houston, TX, USA
Effectiveness of Needleless Vial Adaptors and Blunt Cannulas for Drug Administration in a Microgravity Environment
Hailey, M.; Bayuse, T.; May 09, 2010; 12 pp.; In English; 81st Annual Scientific Meeting of the Aerospace Medical Association, 9-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations
Report No.(s): JSC-CN-20579; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018590

Fluid Isolation in the medication vial: Air/ fluid isolation maneuvers were used to move the medication to the septum end of vial. This isolation may be achieved in multiple ways based on the experience of the astronaut with fluid management in

microgravity. If vial adaptors/blunt cannula or syringe assembly is inserted into the to vial before fluid isolation commences, the stability of this assembly should be considered in an effort to limit the risk of 'slinging off' of the vial during isolation. Alternatively, fluid isolation can be performed prior to attaching the syringe/vial adaptor assembly. Terrestrial practices for medication withdrawal from a nonvented vial require injection of an equivalent amount of air as the expected medication volume prior to withdrawing liquid. In microgravity, this action is still valid, however the injection of additional air into the vial creates a multitude of micro bubbles and increases the volume of medication mixed with air that then must be withdrawn to achieve the desired drug volume in syringe. This practice is more likely to be required when using vials >30ml in size and injection volumes >10mL. It is felt that based on the microgravity flight, the practice of air injection is more of a hindrance than help.
Author
Fluid Management; Syringes; Drugs; Microgravity; Risk; Septum; Injection

20100018909 Army Medical Research and Materiel Command, Fort Detrick, MD USA
An Improved Methodology for Individualized Performance Prediction of Sleep-Deprived Individuals with the Two-Process Model
Rajaraman, Srinivasan; Gribok, Andrei V; Wesensten, Nancy J; Balkin, Thomas J; Reifman, Jaques; Jan 2009; 17 pp.; In English
Report No.(s): AD-A518396; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a method based on the two-process model of sleep regulation for developing individualized biomathematical models that predict performance impairment for individuals subjected to total sleep loss. This new method advances our previous work in two important ways. First, it enables model customization to start as soon as the first performance measurement from an individual becomes available. This was achieved by optimally combining the performance information obtained from the individual's performance measurements with a priori performance information using a Bayesian framework, while retaining the strategy of transforming the nonlinear optimization problem of finding the optimal estimates of the two-process model parameters into a series of linear optimization problems. Second, by taking advantage of the linear representation of the two-process model, this new method enables the analytical computation of statistically based measures of reliability for the model predictions in the form of prediction intervals. Two distinct data sets were used to evaluate the proposed method. Results using simulated data with superimposed white Gaussian noise showed that the new method yielded 50% to 90% improvement in parameter-estimate accuracy over the previous method. Moreover, the accuracy of the analytically computed prediction intervals was validated through Monte Carlo simulations. Results for subjects representing three sleep-loss phenotypes who participated in a laboratory study (82 h of total sleep loss) indicated that the proposed method yielded individualized predictions that were up to 43% more accurate than group-average prediction models and, on average, 10% more accurate than individualized predictions based on our previous method.
DTIC
Biological Models (Mathematics); Mathematical Models; Mental Performance; Performance Prediction; Sleep; Sleep Deprivation

20100019297 Naval Research Lab., Washington, DC USA
Mitigating Motion Sickness in Ground Vehicles
Coyne, J T; Stripling, R; Rovira, E; Hunter, D; Cohn, J V; Brendley, K; Zwick, G; Carter, G; Jan 2008; 3 pp.; In English
Report No.(s): AD-A517884; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517884

Motion sickness (MS) represents a challenge to many warfighters, particularly those in command and control vehicles (C2V). Research by the U.S. Army and NASA suggests that as many as 90% of operators in a C2V experience some performance decrements and MS symptoms. Common solutions to MS emphasize pharmacological interventions, such as promethazine and dimenhydrinate (Dramamine trade mark). The challenge with these approaches is that they often lead to decrements in cognitive performance and drowsiness. The sensory conflict theory suggests that MS arises in conditions where the sensory systems, specifically the visual and vestibular systems, detect different motions. This paper provides evidence for an information technology solution to MS, called Motion Coupled Visual Environment (MOCOVE),2 which attempts to resolve MS by artificially introducing couplings between visual and vestibular motion cues.
DTIC
Motion Sickness; Command and Control; Visual Stimuli

20100019709 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development of a Novel Noise Delivery System for JP-8 Ototoxicity Studies

Stubbs, John E; Mar 2010; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519014; AFIT/GIH/ENV/10-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519014

Numerous chemicals with ototoxic properties may cause hearing loss directly, potentiate noise-induced hearing loss, or produce additive effects. Of interest to the US Air Force are studies showing ototoxic effects of JP-8 jet fuel and its hydrocarbon constituents. The Naval Health Research Center (NHRC) at Wright-Patterson AFB, Ohio, in conjunction with the USAF, is studying the ototoxic effects of JP-8 in rats. The study requires a white noise source that is one octave band wide, centered at 8 kHz frequency, delivered from outside of exposure chambers. Sound pressure levels must be within +/- 2 dB at all exposure points within each chamber and within +/- 2 dB over a 6-hour run. Electrodynamic shakers were successfully used to produce the required input noise in three exposure chambers by inducing vibration in chamber plenums. Distribution of sound pressure levels across chamber exposure points were well controlled within a +/- 1.5 dB prediction interval (= 0.05) or better. Stability at a central reference point was well controlled over 6-hour runs within a +/- 1 dB prediction interval (= 0.05) or better. The final system solution gives the NHRC a unique capability to deliver noise and whole-body JP-8 aerosol exposures simultaneously.

DTIC

Auditory Defects; JP-8 Jet Fuel; Sound Pressure

20100019993 Northrop Grumman Corp., San Antonio, TX USA

The Effects of Sleep Deprivation on Flight Performance, Instrument Scanning, and Physiological Arousal in Pilots

Previc, Fred H; Lopez, Nadia; Ercoline, William R; Daluz, Christina M; Workman, Andrew J; Evans, Richard H; Dillon, Nathan A; Jan 2009; 22 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A519631; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effects of 34 hr of continuous wakefulness on flight performance, instrument scanning, subjective fatigue, and EEG activity were measured. Ten fixed-wing military pilots flew a series of 10 simulator profiles, and root mean squared error was calculated for various flight parameters. Ocular scan patterns were obtained by magnetic head tracking and infrared eye tracking. Flying errors peaked after about 24 to 28 hr of continuous wakefulness in line with peaks in subjective fatigue and EEG theta activity, and they were not directly attributable to degradation of instrument scanning, which was very consistent across pilots and largely unaffected by the sleep deprivation.

DTIC

Arousal; Cognition; Flight Characteristics; Mental Performance; Physiology; Pilots; Sleep Deprivation

20100020036 Human Effectiveness Directorate, Wright-Patterson AFB, OH USA

Simulator-Induced Spatial Disorientation: Effects of Age, Sleep Deprivation, and Type of Conflict

Previc, Fred H; Ercoline, William R; Evans, Richard H; Dillon, Nathan; Lopez, Nadia; Daluz, Christina M; Workman, Andrew; May 2007; 9 pp.; In English

Contract(s)/Grant(s): Proj-7757

Report No.(s): AD-A519750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Spatial disorientation mishaps are greater at night and with greater time on task, and sleep deprivation is known to decrease cognitive and overall flight performance. However, the ability to perceive and to be influenced by physiologically appropriate simulated SD conflicts has not previously been studied in an automated simulator flight profile. Methods: A set of 10 flight profiles were flown by 10 U.S. Air Force (USAF) pilots over a period of 28 h in a specially designed flight simulator for spatial disorientation research and training. Of the 10 flights, 4 had a total of 7 spatial disorientation (SD) conflicts inserted into each of them, 5 simulating motion illusions and 2 involving visual illusions. The percentage of conflict reports was measured along with the effects of four conflicts on flight performance. Results: The results showed that, with one exception, all motion conflicts were reported over 60% of the time, whereas the two visual illusions were reported on average only 25% of the time, although they both significantly affected flight performance. Pilots older than 35 yr of age were more likely to report conflicts than were those under 30 yr of age (63% vs. 38%), whereas fatigue had little effect overall on either recognized or unrecognized SD. Discussion: The overall effects of these conflicts on perception and performance were

generally not altered by sleep deprivation, despite clear indications of fatigue in our pilots.
DTIC
Age Factor; Pilots; Sleep Deprivation; Spatial Distribution

20100020037 Human Effectiveness Directorate, Wright-Patterson AFB, OH USA
Considerations of Pharmacology on Fitness for Duty in the Operational Environment
Kautz, Mary A; Thomas, Maria L; Caldwell, J L; May 2007; 7 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A519751; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Coordination of strategies for transitioning psychoactive pharmacological compounds from basic laboratory research to the field environment has been an ongoing effort among military laboratories. Several workshops have been held specifically to address the operationally relevant issues and other military and scientific challenges as they relate to the enhancement and sustainability of cognitive performance. In this preface, we tie together recommendations of the Pharmacological Strategies Focus Team for one such Workshop, review current literature, and discuss findings reported at recent professional meetings. The papers presented within this pharmacology section are discussed. These section papers are organized into three areas of operational relevance-the first assesses the effectiveness of a treatment given for migraines, a condition with known detrimental effects on productivity and readiness; the second discusses ethical considerations surrounding the use of pharmaceutical countermeasures for fatigue in the operational environment; and the third discusses a case report highlighting the aeromedical considerations regarding selective serotonin reuptake inhibitors (SSRIs) and aviator flight performance, particularly as assessed with neuropsychological testing. The papers and commentaries in this section encourage us to consider the complex variables effecting the decisions to administer pharmacological agents, as the impact of their use is weighed against the cognitive performance effects they may have in the operational environment.
DTIC
Cognition; Countermeasures; Pharmacology; Physical Fitness; Serotonin

20100020209 NASA Johnson Space Center, Houston, TX, USA
Space Medicine: Shuttle - Space Station Crew Health and Safety Challenges for Exploration
Dervay, Joseph; May 18, 2010; 99 pp.; In English; Space Meeting Talk, 18 May 2010, Tarzana, CA, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20511; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020209

This slide presentation combines some views of the shuttle take off, and the shuttle and space station on orbit, and some views of the underwater astronaut training , with a general discussion of Space Medicine. It begins with a discussion of the some of the physiological issues of space flight. These include: Space Motion Sickness (SMS), Cardiovascular, Neurovestibular, Musculoskeletal, and Behavioral/Psycho-social. There is also discussion of the space environment and the issues that are posed including: Radiation, Toxic products and propellants, Habitability, Atmosphere, and Medical events. Included also is a discussion of the systems and crew training. There are also artists views of the Constellation vehicles, the planned lunar base, and extended lunar settlement. There are also slides showing the size of earth in perspective to the other planets, and the sun and the sun in perspective to other stars. There is also a discussion of the in-flight changes that occur in neural feedback that produces postural imbalance and loss of coordination after return.
CASI
Aerospace Medicine; Aerospace Safety; Health; Physiology; Spacecrews; Spacecraft Environments; Astronaut Performance; Space Flight Stress

20100020255 NASA Johnson Space Center, Houston, TX, USA
Occupational Surveillance for Spaceflight Exposures
Tarver, William J.; May 09, 2010; 12 pp.; In English; 81st Annual Scientific Meeting of the Aerospace Medical Association, 9-13 May 2010, Phoenix, AZ, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20666; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020255

This slide presentation reviews the importance of longterm occupational health surveillance of astronauts after exposure to the possible hazards of spaceflight. Because there is not much information about long term effects of spaceflight on human health, it is important to identify some of the possible results of exposure to the many possible factors that can influence

longterm health impacts. This surveillance also allows for NASA to meet the obligation to care for the astronauts for their lifetime.
CASI
Astronauts; Health; Long Term Effects; Aerospace Medicine; Bioastronautics; Aerospace Environments

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20100018504 NASA Johnson Space Center, Houston, TX, USA
Requirements and Sizing Investigation for Constellation Space Suit Portable Life Support System Trace Contaminant Control
Paul, Heather L.; Jennings, Mallory A.; Waguespack, Glenn; [2010]; 17 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 903184.04.02.03.03
Report No.(s): JSC-CN-19767; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018504

The Trace Contaminant Control System (TCCS), located within the ventilation loop of the Constellation Space Suit Portable Life Support System (PLSS), is responsible for removing hazardous trace contaminants from the space suit ventilation flow. This paper summarizes the results of a trade study that evaluated if trace contaminant control could be accomplished without a TCCS, relying on suit leakage, ullage loss from the carbon dioxide and humidity control system, and other factors. Trace contaminant generation rates were revisited to verify that values reflect the latest designs for Constellation Space Suit System (CSSS) pressure garment materials and PLSS hardware. Additionally, TCCS sizing calculations were performed and a literature survey was conducted to review the latest developments in trace contaminant technologies.
Author
Portable Life Support Systems; Space Suits; Trace Contaminants; Constellation Program; Extravehicular Activity

20100018507 NASA Johnson Space Center, Houston, TX, USA
Regenerative Blower for EVA Suit Ventilation Fan
Izenson, Michael G.; Chen, Weibo; Paul, Heather L.; [2010]; 20 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color and black and white illustrations
Contract(s)/Grant(s): 903184.04.02.03.03
Report No.(s): JSC-CN-19855; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018507

Portable life support systems in future space suits will include a ventilation subsystem driven by a dedicated fan. This ventilation fan must meet challenging requirements for pressure rise, flow rate, efficiency, size, safety, and reliability. This paper describes research and development that showed the feasibility of a regenerative blower that is uniquely suited to meet these requirements. We proved feasibility through component tests, blower tests, and design analysis. Based on the requirements for the Constellation Space Suit Element (CSSE) Portable Life Support System (PLSS) ventilation fan, we designed the critical elements of the blower. We measured the effects of key design parameters on blower performance using separate effects tests, and used the results of these tests to design a regenerative blower that will meet the ventilation fan requirements. We assembled a proof-of-concept blower and measured its performance at sub-atmospheric pressures that simulate a PLSS ventilation loop environment. Head/flow performance and maximum efficiency point data were used to specify the design and operating conditions for the ventilation fan. We identified materials for the blower that will enhance safety for operation in a lunar environment, and produced a solid model that illustrates the final design. The proof-of-concept blower produced the flow rate and pressure rise needed for the CSSE ventilation subsystem while running at 5400 rpm, consuming only 9 W of electric power using a non-optimized, commercial motor and controller and inefficient bearings. Scaling the test results to a complete design shows that a lightweight, compact, reliable, and low power regenerative blower can meet the performance requirements for future space suit life support systems.
Author
Blowers; Extravehicular Activity; Portable Life Support Systems; Space Suits; Ventilation Fans; Computational Fluid Dynamics

20100018947 Defense Acquisition Univ., Fort Belvoir, VA USA

The F119 Engine: A Success Story of Human Systems Integration in Acquisition

Liu, Kevin K; Valerdi, Ricardo; Rhodes, Donna H; Kimm, Larry; Headen, Alvis; Apr 2010; 19 pp.; In English

Report No.(s): AD-A518530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense recently mandated the incorporation of Human Systems Integration (HSI) early in the acquisition cycle to improve system performance and reduce ownership cost. However, little documentation of successful examples of HSI within the context of systems engineering exists, making it difficult for the acquisition community to disseminate and apply best practices. This article presents a case study of a large Air Force project that represents a successful application of HSI. The authors explore the influence of both the Air Force and the project contractor. Additionally, they identify top-level leadership support for integrating HSI into systems engineering processes as key to HSI success, reinforcing the importance of treating HSI as an integral part of pre-Milestone A activities.

DTIC

Acquisition; Aircraft Engines; Human Factors Engineering; Systems Integration

20100018984 Naval Postgraduate School, Monterey, CA USA

Attentional Drift: An Exploratory Study into the Development of an Attention Level Monitoring System Based on Human Eye Fixation

Magedman, Douglas M; Mar 2010; 72 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518630; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study was designed to determine if future research into the development of an attention monitoring device based on eye fixation duration is both feasible and warranted. Attentional Drift is an insidious form of distraction where primary task attention is slowly eroded by secondary tasking. It most often occurs in very low or very high cognitive demand situations. Recent studies have shown that eye fixation duration and glance duration measures are related to attentional demand in visual tasks. In this study, participants completed two 20-minute driving periods in a STISIM II (trademark) simulator wearing a head-mounted eye-tracking system. Eye fixation measures recorded in a single-task low mental demand test did not show an expected increase in eye fixation duration over time in all but a few participants. A second test incorporating dual tasking through conversation did show that eye fixation duration values were affected by the added cognitive workload. Eye fixation measures showed statistically significant changes in duration as a direct result of varying secondary cognitive demand. It is concluded that further experimentation with significantly lengthened test runs incorporating an eye blink rate factor, a gaze dwell time function, and a fixed-base eye-tracking system is both feasible and warranted.

DTIC

Cognition; Eye (Anatomy); Motor Vehicles; Visual Perception

20100018991 Socio-Technical System Sciences, Sarasota, FL USA

Transformational Impact of Digital Natives on Cultures, Commerce and Societies

Boff, Kenneth R; Apr 8, 2010; 53 pp.; In English

Contract(s)/Grant(s): FA2386-10-1-4008

Report No.(s): AD-A518638; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research effort developed an informed perspective on the digital native phenomenon drawing on the extant literature and leveraged interactions with recognized thought leaders. It was determined that the best way to identify and rationalize the fundamental science needed in this area would be to convene a workshop of thought leaders in this area. In November of 2009, we convened a three day workshop at the Korean Advanced Institute for Science and Engineering (KAIST) in Taejeon, South Korea. The workshop was successful by all accounts. The principal insights and areas for recommended research are reported herein.

DTIC

Commerce; Grammars

20100019156 NASA Johnson Space Center, Houston, TX, USA

Development of a Fan for Future Space Suit Applications

Paul. Heather L.; Converse, David; Dionne, Steven; Moser, Jeff; [2010]; 15 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations

Contract(s)/Grant(s): NNJ05HB39B; CRAVE-EC-039; WBS 903184.04.02.03.03

Report No.(s): JSC-CN-20006; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019156

NASA's next generation space suit system will place new demands on the fan used to circulate breathing gas through the

ventilation loop of the portable life support system. Long duration missions with frequent extravehicular activities (EVAs), the requirement for significant increases in reliability and durability, and a mission profile that imposes strict limits on weight, volume and power create the basis for a set of requirements that demand more performance than is available from existing fan designs. This paper describes the development of a new fan to meet these needs. A centrifugal fan was designed with a normal operating speed of approximately 39,400 rpm to meet the ventilation flow requirements while also meeting the aggressive minimal packaging, weight and power requirements. The prototype fan also operates at 56,000 rpm to satisfy a second operating condition associated with a single fan providing ventilation flow to two spacesuits connected in series. This fan incorporates a novel nonmetallic 'can' to keep the oxygen flow separate from the motor electronics, thus eliminating ignition potential. The nonmetallic can enables a small package size and low power consumption. To keep cost and schedule within project bounds a commercial motor controller was used. The fan design has been detailed and implemented using materials and approaches selected to address anticipated mission needs. Test data is presented to show how this fan performs relative to anticipated ventilation requirements for the EVA portable life support system. Additionally, data is presented to show tolerance to anticipated environmental factors such as acoustics, shock, and vibration. Recommendations for forward work to progress the technology readiness level and prepare the fan for the next EVA space suit system are also discussed. Author

Space Suits; Breathing Apparatus; Life Support Systems; Ventilation; Oxygen; Gas Mixtures; Extravehicular Activity

20100019167 NASA Johnson Space Center, Houston, TX, USA

Developing Sustainable Life Support System Concepts

Thomas, Evan A.; [2010]; 6 pp.; In English; AIAA International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain

Contract(s)/Grant(s): 432938.09.01.05.03.34

Report No.(s): JSC-CN-19987; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019167

Sustainable spacecraft life support concepts may allow the development of more reliable technologies for long duration space missions. Currently, life support technologies at different levels of development are not well evaluated against each other, and evaluation methods do not account for long term reliability and sustainability of the hardware. This paper presents point-of-departure sustainability evaluation criteria for life support systems, that may allow more robust technology development, testing and comparison. An example sustainable water recovery system concept is presented.
Author

Life Support Systems; Reliability; Water Reclamation; Environmental Control; Space Missions; Time Dependence

20100019169 NASA Johnson Space Center, Houston, TX, USA

Altair Lander Life Support: Requirements Analysis Cycles 1 and 2

Anderson, Molly; Curley, Su; Rotter, Henry; Yagoda, Evan; [2010]; 8 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain

Report No.(s): JSC-CN-20582; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019169

Life support systems are a critical part of human exploration beyond low earth orbit. NASA's Altair Lunar Lander has unique missions to perform and will need a unique life support system to complete them. Initial work demonstrated a feasible minimally -functional Lander design. This work was completed in Design Analysis Cycles (DAC) 1, 2, and 3 were reported in a previous paper'. On October 21, 2008, the Altair project completed the Mission Concept Review (MCR), moving the project into Phase A. In Phase A activities, the project is preparing for the System Requirements Review (SRR). Altair has conducted two Requirements Analysis Cycles (RACs) to begin this work. During this time, the life support team must examine the Altair mission concepts, Constellation Program level requirements, and interfaces with other vehicles and spacesuits to derive the right set of requirements for the new vehicle. The minimum functionality design meets some of these requirements already and can be easily adapted to meet others. But Altair must identify which will be more costly in mass, power, or other resources to meet. These especially costly requirements must be analyzed carefully to be sure they are truly necessary, and are the best way of explaining and meeting the true need. If they are necessary and clear, they become important mass threats to track at the vehicle level. If they are not clear or do not seem necessary to all stakeholders, Altair must work to redefine them or push back on the requirements writers. Additionally, the life support team is evaluating new technologies to see if they are more effective than the existing baseline design at performing necessary functions in Altair's life support system.
Author

Altair Lunar Lander; Life Support Systems; Low Earth Orbits; Space Exploration; Mission Planning; Life (Durability); Design Analysis

20100019347 Jackson (Henry M.) Foundation, Rockville, MD USA

Operator Selection for Unmanned Aerial Vehicle Operators: A Comparison of Video Game Players and Manned Aircraft Pilots

McKinley, R A; McIntire, Lindsey K; Funke, Margaret A; Nov. 2009; 28 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A518309; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the ability to remotely identify enemy activity, track potential targets for extended periods of time, and safely engage the enemy from ground control stations located thousands of miles away, unmanned aerial systems (UAS) have witnessed unprecedented popularity among military leadership and operators. Unfortunately, the accelerated UAS operations tempo has now outpaced current operator training regimens leading to a potential shortage of qualified UAS pilots. This study attempted to discover whether video game players (VGPs) possess superior UAS-relevant cognitive skills when compared to manned aircraft pilots and therefore possibly serve as a viable operator alternative to UAS pilots.

DTIC

Education; Personnel Development; Pilotless Aircraft; Teleoperators

20100019374 Oregon State Univ., Corvallis, OR, USA

Evaluating Safety and Operations of High-Speed Signalized Intersections

Dixon, Karen K.; Kopper, Neil; van Schalkwyk, Ida; March 2010; 146 pp.; In English

Report No.(s): PB2010-107529; No Copyright; Avail.: National Technical Information Service (NTIS)

This Final Report reviews a research effort to evaluate the safety and operations of high-speed intersections in the State of Oregon. In particular, this research effort focuses on four-leg, signalized intersections with speed limits of 45 mph or greater where the intersections are not in the immediate vicinity of other signalized intersections. This report includes a literature review of high-speed intersection safety treatment strategies, a description of the research methodology used in this project, and a summary of final results. The final results include crash conditions at these high-speed intersections, a format for evaluating safety at these and similar intersections, a hierarchy of safety treatment options, and a demonstration of the use of these tools through example analyses of eight Oregon intersections.

NTIS

High Speed; Intersections; Safety; Traffic

20100019415 Biometrics Task Force, Arlington, VA USA

Biometrics Task Force

January 2009; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517637; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517637

When the Army's biometrics program started in 2000, its focus was determining how to use biometrics to secure access to military networks, both on the battlefield and on the home front. This focus began to change in 2003, when DOD saw that biometrics could be used to prevent the enemy in Iraq and Afghanistan from hiding behind a web of multiple identities. It also then became a DOD-wide effort. By 2006, this capability was firmly in place, and DOD saw biometrics as an operational tool. It was also playing a key role in enabling intelligence operations. Today, DOD is using biometrics to verify the identities of known individuals on the ground in Iraq and Afghanistan to enable operations to find capture improvised explosive device (IED) makers and insurgents and to protect the identities of DOD and U.S. government (USG) personnel. Biometrics is being used to ensure that only the right individuals have access to U.S. facilities and networks and to assist in safeguarding the identities of those same individuals. This is the basis of Identify, Enable, Protect: three synergistic but distinct applications of biometrics being used to defeat our enemies and protect our allies, forces, and homeland.

DTIC

Biometrics; Explosive Devices; Personnel; Military Technology

20100019418 Army War Coll., Carlisle Barracks, PA USA

Intelligence and Information: The Proliferation of Uncertainty

Emerson, Ricky; March 2010; 33 pp.; In English

Report No.(s): AD-A518061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518061

Recently, the Intelligence Community received scrutiny for the Fort Hood shootings, the foiled Christmas day terrorist

plot and the death of seven CIA operatives in Afghanistan. Following these events, policy makers examined security measures and the role of intelligence in failing to connect the dots. This report illustrates how multiple instruments of national power and interagency cooperation enhance intelligence analysts ability to connect the dots. Intelligence officials must balance demands for national intelligence systems to collect more data while ensuring the most relevant information is processed and analyzed for intelligence production. Policy decisions may impact intelligence analytical priorities; adding to an uncertain threat environment. Managing uncertainty requires policies, enduring solutions that combine technology and creative intelligence analysis to facilitate capabilities growth. Solutions outlined in this report are better interoperability of intelligence and interagency databases and implementation of a national level biometrics program.
DTIC
Biometrics; Intelligence; Security; Threat Evaluation

20100019422 NASA Johnson Space Center, Houston, TX, USA
Lessons Learned From The EMU Fire and How It Impacts CxP Suit Element Development and Testing
Metts, Jonathan; Hill, Terry; September 15, 2008; 33 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JSC-CN-18755; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019422

During testing a Space Shuttle Extravehicular Mobility Unit (EMU) pressure garment and life-support backpack was destroyed in a flash fire in the Johnson Space Center's Crew systems laboratory. This slide presentation reviews the accident, probable causes, the lessons learned and the effect this has on the testing and the environment for testing of the Space Suit for the Constellation Program.
CASI
Extravehicular Mobility Units; Fires; Lessons Learned; Failure Analysis; Accident Prevention

20100019472 NASA White Sands Test Facility, NM, USA
Operational Considerations for Oxygen Flammability Risks: Concentrated Oxygen Diffusion and Permeation Behaviors
Harper, Susana; Smith, Sarah; Juarez, Alfredo; Hirsch, David; [2010]; 13 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Report No.(s): JSC-CN-20479; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019472

Increased human spaceflight operations utilize oxygen concentrations that are frequently varied with use of concentrations up to 100 percent oxygen. Even after exiting a higher percentage oxygen environment, high oxygen concentrations can still be maintained due to material saturation and oxygen entrapment between barrier materials. This paper examines the material flammability concerns that arise from changing oxygen environments during spaceflight operations. We examine the time required for common spacecraft and spacesuit materials exposed to oxygen to return to reduced ignitability and flammability once removed from the increased concentration. Various common spacecraft materials were considered: spacecraft cabin environment foams, Extra Vehicular Mobility Unit materials and foams, Advanced Crew Escape Suit materials, and other materials of interest such as Cotton, Nomex^ HT90-40, and Tiburon Surgical Drape. This paper presents calculated diffusion coefficients derived from experimentally obtained oxygen transmission rates for the tested materials and the analytically derived times necessary for reduced flammability to be achieved based on NASA flammability criteria. Oxygen material saturation and entrapment scenarios are examined. Experimental verification data on oxygen diffusion in saturation scenarios are also presented and discussed. We examine how to use obtained data to address flammability concerns during operational planning to reduce the likelihood of fires while improving efficiency for procedures.
Author
Flammability; Oxygen; Risk; Diffusion Coefficient; Permeating; Manned Space Flight

20100019488 NASA Johnson Space Center, Houston, TX, USA
Functional Mobility Testing. Quantification of Functionally Utilized Mobility Among Unsuited and Suited Subjects
England, Scott A.; Benson, Elizabeth A.; Rajulu, Sudhakar L.; April 2010; 94 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-20494; Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019488

A novel approach was used in this test for the creation of mobility requirements to be fed into the Human-Systems

Integration Requirements and Engineering Requirements Documents. Existing suits may not provide adequate mobility to perform all functional tasks required in future missions. Looking solely at maximum unsuited mobility could be unrealistic and unnecessary to design into a suit. The new approach focused instead on functional range of motion. Setting design requirements based on the mobility necessary to perform a broad spectrum of functional tasks should save resources while still providing a suit capable of performing all tasks that a suited crewmember is likely to encounter. Unsuited functional mobility testing revealed some interesting nuances of human movement including variances in mobility utilized when completing functional tasks as well as the impact of compound joint motions and the influence of joint loading on range of motion. Suited requirements must reflect the fact that altered movement strategies are utilized while wearing a space suit. Improved methods for the creation of space suit design requirements should lead to improved suit performance while maintaining crewmember safety and reducing overall costs.
Author
Mobility; Space Suits; Systems Integration; Range (Extremes); Spacecrews; Safety

20100019559 NASA Johnson Space Center, Houston, TX, USA
Lunar Surface Systems Wet-Bath Design Evaluation
Thompson, Shelby; Szabo, Rich; Howard, Robert; [2010]; 1 pp.; In English; Seventh Annual One-Day Symposium of Human Factors and Ergonomics, 21 May 2010, Houston, TX, USA
Report No.(s): JSC-CN-20563; Copyright; Avail.: Other Sources; Abstract Only

The goal of the current evaluation was to examine five different wet-bath architectural design concepts. The primary means of testing the concepts required participants to physically act-out a number of functional tasks (e.g., shaving, showering, changing clothes, maintenance) in order to give judgments on the affordance of the volume as based on the design concepts. Each of the concepts was designed in such a way that certain features were exploited - for example, a concept may have a large amount of internal stowage, but minimum amount of usable space to perform tasks. The results showed that the most preferred concept was one in which stowage and usable space were balanced. This concept allowed for a moderate amount of stowage with some suggested redesign, but would not preclude additional personal items such as clothing. This concept also allowed for a greater distance to be achieved between the toilet and the sink with minimum redesign, which was desirable. Therefore, the all-in-one (i.e., toilet, sink, and shower all occupying a single volume) wet-bath concept seemed to be a viable solution in which there is a minimal amount of overall volume available with certain lunar habitat configurations.
Author
Baths; Lunar Surface; Systems Engineering; Habitats; Clothing

20100019580 NASA, Washington, DC, USA
NASA Tech Briefs, May 2010
May 2010; 44 pp.; In English; See also 20100019581 - 20100019627; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019580

Topics covered include: Instrument for Analysis of Greenland's Glacier Mills Cryogenic Moisture Apparatus; A Transportable Gravity Gradiometer Based on Atom Interferometry; Three Methods of Detection of Hydrazines; Crossed, Small-Deflection Energy Analyzer for Wind/Temperature Spectrometer; Wavefront Correction for Large, Flexible Antenna Reflector; Novel Micro Strip-to-Waveguide Feed Employing a Double-Y Junction; Thin-Film Ferro Electric-Coupled Microstripline Phase Shifters With Reduced Device Hysteresis; Two-Stage, 90-GHz, Low-Noise Amplifier; A 311-GHz Fundamental Oscillator Using InP HBT Technology; FPGA Coprocessor Design for an Onboard Multi-Angle Spectro-Polarimetric Imager; Serrating Nozzle Surfaces for Complete Transfer of Droplets; Turbomolecular Pumps for Holding Gases in Open Containers; Triaxial Swirl Injector Element for Liquid-Fueled Engines; Integrated Budget Office Toolbox; PLOT3D Export Tool for Tecplot; Math Description Engine Software Development Kit; Astronaut Office Scheduling System Software; ISS Solar Array Management; Probabilistic Structural Analysis Program; SPOT Program; Integrated Hybrid System Architecture for Risk Analysis; System for Packaging Planetary Samples for Return to Earth; Offset Compound Gear Drive; Low-Dead-Volume Inlet for Vacuum Chamber; Simple Check Valves for Microfluidic Devices; A Capillary-Based Static Phase Separator for Highly Variable Wetting Conditions; Gimballing Spacecraft Thruster; Finned Carbon-Carbon Heat Pipe with Potassium Working Fluid; Lightweight Heat Pipes Made from Magnesium; Ceramic Rail-Race Ball Bearings; Improved OTEC System for a Submarine Robot; Reflector Surface Error Compensation in Dual-Reflector Antennas; Enriched Storable Oxidizers for Rocket Engines; Planar Submillimeter-Wave Mixer Technology with Integrated Antenna; Widely Tunable Mode-Hop-Free External-Cavity Quantum Cascade Laser; Non-Geiger-Mode Single-Photon Avalanche Detector with Low Excess Noise; Using Whispering-Gallery-Mode Resonators for Refractometry; RF Device for Acquiring Images of the Human

Body; Reactive Collision Avoidance Algorithm; Fast Solution in Sparse LDA for Binary Classification; Modeling Common-Sense Decisions in Artificial Intelligence; Graph-Based Path-Planning for Titan Balloons; Nanolaminate Membranes as Cylindrical Telescope Reflectors; Air-Sea Spray Airborne Radar Profiler Characterizes Energy Fluxes in Hurricanes; Large Telescope Segmented Primary Mirror Alignment; and Simplified Night Sky Display System.
Author
Airborne Radar; Artificial Intelligence; Ball Bearings; Ceramics; Collision Avoidance; Display Devices; Engine Design; Gravity Gradiometers; Heterojunction Devices; Interferometry; Laser Doppler Velocimeters; Whispering Gallery Modes

20100019581 California Inst. of Tech., Pasadena, CA, USA
Nanolaminate Membranes as Cylindrical Telescope Reflectors
Dooley, Jennifer; Dragovan, Mark; Hickey, Gregory; Lih, Shyh-Shiu Lih; NASA Tech Briefs, May 2010; May 2010, pp. 39; In English; See also 20100019580
Report No.(s): NPO-40797; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019581; http://www.techbriefs.com/component/content/article/7968

A document discusses a proposal to use axially stretched metal nanolaminate membranes as lightweight parabolic cylindrical reflectors in the Dual Anamorphic Reflector Telescope (DART) - a planned spaceborne telescope in which the cylindrical reflectors would be arranged to obtain a point focus. The discussion brings together a combination of concepts reported separately in several prior NASA Tech Briefs articles, the most relevant being 'Nanolaminate Mirrors With Integral Figure-Control Actuators' NPO -30221, Vol. 26, No. 5 (May 2002), page 90; and 'Reflectors Made From Membranes Stretched Between Beams' NPO -30571, Vol. 33, No. 10 (October 2009), page 11a. The engineering issues receiving the greatest emphasis in the instant document are (1) the change in curvature associated with the Poisson contraction of a stretched nanolaminate reflector membrane and (2) the feasibility of using patches of poly(vinylidene fluoride) on the rear membrane surface as piezoelectric actuators to correct the surface figure for the effect of Poisson contraction and other shape errors.
Author
Cylindrical Bodies; Membranes; Parabolic Reflectors; Spaceborne Telescopes; Piezoelectric Actuators; Mirrors

20100019582 California Inst. of Tech., Pasadena, CA, USA
Large Telescope Segmented Primary Mirror Alignment
Rud, Mayer; NASA Tech Briefs, May 2010; May 2010, pp. 39; In English; See also 20100019580
Report No.(s): NPO-47032; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019582; http://www.techbriefs.com/component/content/article/7971

A document discusses a broadband (white light) point source, located at the telescope Cassegrain focus, which generates a cone of light limited by the hole in the secondary mirror (SM). It propagates to the aspheric null-mirror, which is optimized to make all the reflected rays to be normal to the primary mirror (PM) upon reflection. PM retro-reflects the rays back through the system for wavefront analysis. The point source and the wavefront analysis subsystems are all located behind the PM. The PM phasing is absolute (white light) and does not involve the SM. A relatively small, aspheric null-mirror located near the PM center of curvature has been designed to deliver the high level of optical wavefront correction. The phasing of the segments is absolute due to the use of a broadband source. The segmented PM is optically aligned independently and separately from the SM alignment. The separation of the PM segments alignment from the PM to the SM, and other telescope optics alignments, may be a significant advantage, eliminating the errors coupling. The point source of this concept is fully cooperative, unlike a star or laser-generated guide-star, providing the necessary brightness for the optimal S/N ratio, the spectral content, and the stable on-axis position. This concept can be implemented in the lab for the PM initial alignment, or made to be a permanent feature of the space-based or groundbased telescope.
Derived from text
Alignment; Segmented Mirrors; Telescopes; Point Sources; Broadband; Cassegrain Optics

20100019583 NASA Marshall Space Flight Center, Huntsville, AL, USA
Enriched Storable Oxidizers for Rocket Engines
Sackheim, R. L.; Herdy, J. R., Jr.; NASA Tech Briefs, May 2010; May 2010, pp. 30-31; In English; See also 20100019580; Original contains color illustrations
Report No.(s): MFS-32407-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019583; http://www.techbriefs.com/component/content/article/7963

The name 'enriched storable oxidizers' (ESOs) has been coined for a family of optimized mixtures of between two and

four oxidizer fluids. For most applications, the constituents of these mixtures would be nitrogen tetroxide (N2O4), nitrous oxide (N2O), and nitrogen dioxide (NO2); in some applications, the mixtures might include inhibited red fuming nitric acid [IRFN (which consists of red fuming nitric acid to which some hydrogen fluoride is added to reduce its corrosive effect]. The optimum proportions of these constituents would be different for different applications. ESOs were originally proposed for use in spacecraft and launch-rocket propulsion systems: ESOs could be especially useful in advanced spacecraft propulsion systems that could operate in multiple modes. ESOs might also be useful in special terrestrial applications that could include ramjet and scramjet aircraft engines.
Author
Nitrogen Tetroxide; Nitrous Oxides; Oxidizers; Nitrogen Dioxide; Nitric Acid; Hydrofluoric Acid; Corrosion; Room Temperature

20100019584 NASA Johnson Space Center, Houston, TX, USA
SPOT Program
Smith, Jason T.; Welsh, Sam J.; Farinetti, Antonio L.; Wegner, Tim; Blakeslee, James; Deboeck, Toni F.; Dyer, Daniel; Corley, Bryan M.; Ollivierre, Jarmaine; Kramer, Leonard; Zimmerman, Patrick L.; Khatri, Reshma; NASA Tech Briefs, May 2010; May 2010, pp. 20-21; In English; See also 20100019580
Report No.(s): MSC-24482-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019584; http://www.techbriefs.com/component/content/article/7947

A Spacecraft Position Optimal Tracking (SPOT) program was developed to process Global Positioning System (GPS) data, sent via telemetry from a spacecraft, to generate accurate navigation estimates of the vehicle position and velocity (state vector) using a Kalman filter. This program uses the GPS onboard receiver measurements to sequentially calculate the vehicle state vectors and provide this information to ground flight controllers. It is the first real-time ground-based shuttle navigation application using onboard sensors. The program is compact, portable, self-contained, and can run on a variety of UNIX or Linux computers. The program has a modular objec-toriented design that supports application-specific plugins such as data corruption remediation pre-processing and remote graphics display. The Kalman filter is extensible to additional sensor types or force models. The Kalman filter design is also strong against data dropouts because it uses physical models from state and covariance propagation in the absence of data. The design of this program separates the functionalities of SPOT into six different executable processes. This allows for the individual processes to be connected in an a la carte manner, making the feature set and executable complexity of SPOT adaptable to the needs of the user. Also, these processes need not be executed on the same workstation. This allows for communications between SPOT processes executing on the same Local Area Network (LAN). Thus, SPOT can be executed in a distributed sense with the capability for a team of flight controllers to efficiently share the same trajectory information currently being computed by the program. SPOT is used in the Mission Control Center (MCC) for Space Shuttle Program (SSP) and International Space Station Program (ISSP) operations, and can also be used as a post -flight analysis tool. It is primarily used for situational awareness, and for contingency situations.
Author
Spacecraft Tracking; Global Positioning System; Telemetry; State Vectors; Space Navigation; Flight Control

20100019585 United Space Alliance, Huntsville, AL, USA
ISS Solar Array Management
Williams, James P.; Martin, Keith D.; Thomas, Justin R.; Caro, Samuel; NASA Tech Briefs, May 2010; May 2010, pp. 20; In English; See also 20100019580
Report No.(s): MSC-24425-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019585; http://www.techbriefs.com/component/content/article/7945

The International Space Station (ISS) Solar Array Management (SAM) software toolset provides the capabilities necessary to operate a spacecraft with complex solar array constraints. It monitors spacecraft telemetry and provides interpretations of solar array constraint data in an intuitive manner. The toolset provides extensive situational awareness to ensure mission success by analyzing power generation needs, array motion constraints, and structural loading situations. The software suite consists of several components including samCS (constraint set selector), samShadyTimers (array shadowing timers), samWin (visualization GUI), samLock (array motion constraint computation), and samJet (attitude control system configuration selector). It provides high availability and uptime for extended and continuous mission support. It is able to support two-degrees-of-freedom (DOF) array positioning and supports up to ten simultaneous constraints with intuitive 1D and 2D decision support visualizations of constraint data. Display synchronization is enabled across a networked control center and multiple methods for constraint data interpolation are supported. Use of this software toolset increases flight safety, reduces mission support effort, optimizes solar array operation for achieving mission goals, and has run for weeks at a time

without issues. The SAM toolset is currently used in ISS real-time mission operations.
Author
International Space Station; Solar Arrays; Software Development Tools; Graphical User Interface; Real Time Operation; Telemetry; Control Systems Design; Flight Safety; Computer Systems Programs; Timing Devices

20100019586 California Inst. of Tech., Pasadena, CA, USA
Modeling Common-Sense Decisions in Artificial Intelligence
Zak, Michail; NASA Tech Briefs, May 2010; May 2010, pp. 38; In English; See also 20100019580
Report No.(s): NPO-44114; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019586; http://www.techbriefs.com/component/content/article/7966

A methodology has been conceived for efficient synthesis of dynamical models that simulate common-sense decision-making processes. This methodology is intended to contribute to the design of artificial-intelligence systems that could imitate human common-sense decision making or assist humans in making correct decisions in unanticipated circumstances. This methodology is a product of continuing research on mathematical models of the behaviors of single- and multi-agent systems known in biology, economics, and sociology, ranging from a single-cell organism at one extreme to the whole of human society at the other extreme. Earlier results of this research were reported in several prior NASA Tech Briefs articles, the three most recent and relevant being Characteristics of Dynamics of Intelligent Systems (NPO -21037), NASA Tech Briefs, Vol. 26, No. 12 (December 2002), page 48; Self-Supervised Dynamical Systems (NPO-30634), NASA Tech Briefs, Vol. 27, No. 3 (March 2003), page 72; and Complexity for Survival of Living Systems (NPO- 43302), NASA Tech Briefs, Vol. 33, No. 7 (July 2009), page 62. The methodology involves the concepts reported previously, albeit viewed from a different perspective. One of the main underlying ideas is to extend the application of physical first principles to the behaviors of living systems. Models of motor dynamics are used to simulate the observable behaviors of systems or objects of interest, and models of mental dynamics are used to represent the evolution of the corresponding knowledge bases. For a given system, the knowledge base is modeled in the form of probability distributions and the mental dynamics is represented by models of the evolution of the probability densities or, equivalently, models of flows of information. Autonomy is imparted to the decisionmaking process by feedback from mental to motor dynamics. This feedback replaces unavailable external information by information stored in the internal knowledge base. Representation of the dynamical models in a parameterized form reduces the task of common-sense-based decision making to a solution of the following hetero-associated-memory problem: store a set of m predetermined stochastic processes given by their probability distributions in such a way that when presented with an unexpected change in the form of an input out of the set of M inputs, the coupled motormental dynamics converges to the corresponding one of the m pre-assigned stochastic process, and a sample of this process represents the decision.
Author
Artificial Intelligence; Decision Making; Information Systems; Knowledge Based Systems; Mental Performance; Probability Distribution Functions; Stochastic Processes

20100019587 NASA Johnson Space Center, Houston, TX, USA
A Capillary-Based Static Phase Separator for Highly Variable Wetting Conditions
Thomas, Evan A.; Graf, John C.; Weislogel, Mark M.; NASA Tech Briefs, May 2010; May 2010, pp. 25-26; In English; See also 20100019580; Original contains color illustrations
Report No.(s): MSC-24441-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019587; http://www.techbriefs.com/component/content/article/7956

The invention, a static phase separator (SPS), uses airflow and capillary wetting characteristics to passively separate a two-phase (liquid and air) flow. The device accommodates highly variable liquid wetting characteristics. The resultant design allows for a range of wetting properties from about 0 to over 90 advancing contact angle, with frequent complete separation of liquid from gas observed when using appropriately scaled test conditions. Additionally, the design accommodates a range of air-to-liquid flow-rate ratios from only liquid flow to over 200:1 air-to-liquid flow rate. The SPS uses a helix input section with an ice-cream-cone-shaped constant area cross section (see figure). The wedge portion of the cross section is on the outer edge of the helix, and collects the liquid via centripetal acceleration. The helix then passes into an increasing cross-sectional area vane region. The liquid in the helix wedge is directed into the top of capillary wedges in the liquid containment section. The transition from diffuser to containment section includes a 90 change in capillary pumping direction, while maintaining inertial direction. This serves to impinge the liquid into the two off-center symmetrical vanes by the airflow. Rather than the airflow serving to shear liquid away from the capillary vanes, the design allows for further penetration of the liquid into the vanes by the air shear. This is also assisted by locating the air exit ports downstream of the liquid drain port. Additionally, any droplets not contained in the capillary vanes are re-entrained downstream by a third opposing capillary vane, which directs

liquid back toward the liquid drain port. Finally, the dual air exit ports serve to slow the airflow down, and to reduce the likelihood of shear. The ports are stove-piped into the cavity to form an unfriendly capillary surface for a wetting fluid to carryover. The liquid drain port is located at the start of the containment region, allowing for draining the bulk fluid in a continuous circuit. The functional operation of the SPS involves introducing liquid flow (from a human body, a syringe, or other source) to the two-phase inlet while an air fan pulls on the air exit lines. The fan is operated until the liquid is fully introduced. The system is drained by negative pressure on the liquid drain lines when the SPS containment system is full.
Author
Flow Velocity; Drops (Liquids); Liquid Flow; Two Phase Flow; Wetting; Cavities; Containment; Drainage

20100019588 California Inst. of Tech., Pasadena, CA, USA
System for Packaging Planetary Samples for Return to Earth
Badescu, Mircea; Bar-Cohen, Yoseph; Backes, paul G.; Sherrit, Stewart; Bao, Xiaoqi; Scott, James S.; NASA Tech Briefs, May 2010; May 2010, pp. 23; In English; See also 20100019580; Original contains color illustrations
Report No.(s): NPO-46089; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019588; http://www.techbriefs.com/component/content/article/7952

A system is proposed for packaging material samples on a remote planet (especially Mars) in sealed sample tubes in preparation for later return to Earth. The sample tubes (Figure 1) would comprise (1) tubes initially having open tops and closed bottoms; (2) small, bellows-like collapsible bodies inside the tubes at their bottoms; and (3) plugs to be eventually used to close the tops of the tubes. The top inner surface of each tube would be coated with solder. The side of each plug, which would fit snugly into a tube, would feature a solder-filled ring groove. The system would include equipment for storing, manipulating, filling, and sealing the tubes. The containerization system (see Figure 2) will be organized in stations and will include: the storage station, the loading station, and the heating station. These stations can be structured in circular or linear pattern to minimize the manipulator complexity, allowing for compact design and mass efficiency. The manipulation of the sample tube between stations is done by a simple manipulator arm. The storage station contains the unloaded sample tubes and the plugs before sealing as well as the sealed sample tubes with samples after loading and sealing. The chambers at the storage station also allow for plug insertion into the sample tube. At the loading station the sample is poured or inserted into the sample tube and then the tube is topped off. At the heating station the plug is heated so the solder ring melts and seals the plug to the sample tube. The process is performed as follows: Each tube is filled or slightly overfilled with sample material and the excess sample material is wiped off the top. Then, the plug is inserted into the top section of the tube packing the sample material against the collapsible bellowslike body allowing the accommodation of the sample volume. The plug and the top of the tube are heated momentarily to melt the solder in order to seal the tube.
Author
Expandable Structures; Packaging; Mars Surface Samples; Materials Handling; Samples; Coatings; Plugs

20100019589 California Inst. of Tech., Pasadena, CA, USA
RF Device for Acquiring Images of the Human Body
Gaier, Todd C.; McGrath, William R.; NASA Tech Briefs, May 2010; May 2010, pp. 35; In English; See also 20100019580; Original contains color illustrations
Report No.(s): NPO-42662; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019589; http://www.techbriefs.com/component/content/article/7877

A safe, non-invasive method for forming images through clothing of large groups of people, in order to search for concealed weapons either made of metal or not, has been developed. A millimeter wavelength scanner designed in a unique, ring-shaped configuration can obtain a full 360 image of the body with a resolution of less than a millimeter in only a few seconds. Millimeter waves readily penetrate normal clothing, but are highly reflected by the human body and concealed objects. Millimeter wave signals are nonionizing and are harmless to human tissues when used at low power levels. The imager (see figure) consists of a thin base that supports a small-diameter vertical post about 7 ft (=2.13 m) tall. Attached to the post is a square-shaped ring 2 in. (=5 cm) wide and 3 ft (=91 cm) on a side. The ring is oriented horizontally, and is supported halfway along one side by a connection to a linear bearing on the vertical post. A planar RF circuit board is mounted to the inside of each side of the ring. Each circuit board contains an array of 30 receivers, one transmitter, and digitization electronics. Each array element has a printed-circuit patch antenna coupled to a pair of mixers by a 90 coupler. The mixers receive a reference local oscillator signal to a subharmonic of the transmitter frequency. A single local oscillator line feeds all 30 receivers on the board. The resulting MHz IF signals are amplified and carried to the edge of the board where they are demodulated and digitized. The transmitted signal is derived from the local oscillator at a frequency offset determined by a crystal oscillator. One antenna centrally located on each side of the square ring provides the source illumination power. The

total transmitted power is less than 100 mW, resulting in an exposure level that is completely safe to humans. The output signals from all four circuit boards are fed via serial connection to a data processing computer. The computer processes the approximately 1-MB data set into a three-dimensional image in a matter of seconds. The innovation is to configure the receiver array in a ring topology surrounding the scanned object. The ring is then scanned vertically to cover the necessary two-dimensional surface. This fabrication of the ring is made possible by using planar antenna and circuit technology. A planar circuit board serves as a medium for both antennas and signal processing components. Using this technique, parts counts are kept low, and the cost per element is a small fraction of a waveguide-based system.
Author
Fabrication; Human Body; Radio Frequencies; Images; Technology Utilization; Mechanical Devices; Portable Equipment

20100019590 NASA Langley Research Center, Hampton, VA, USA
PLOT3D Export Tool for Tecplot
Alter, Stephen; NASA Tech Briefs, May 2010; May 2010, pp. 19; In English; See also 20100019580
Report No.(s): LAR -17678-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019590; http://www.techbriefs.com/component/content/article/7942

The PLOT3D export tool for Tecplot solves the problem of modified data being impossible to output for use by another computational science solver. The PLOT3D Exporter add-on enables the use of the most commonly available visualization tools to engineers for output of a standard format. The exportation of PLOT3D data from Tecplot has far reaching effects because it allows for grid and solution manipulation within a graphical user interface (GUI) that is easily customized with macro language-based and user-developed GUIs. The add-on also enables the use of Tecplot as an interpolation tool for solution conversion between different grids of different types. This one add-on enhances the functionality of Tecplot so significantly, it offers the ability to incorporate Tecplot into a general suite of tools for computational science applications as a 3D graphics engine for visualization of all data. Within the PLOT3D Export Add-on are several functions that enhance the operations and effectiveness of the add-on. Unlike Tecplot output functions, the PLOT3D Export Add-on enables the use of the zone selection dialog in Tecplot to choose which zones are to be written by offering three distinct options - output of active, inactive, or all zones (grid blocks). As the user modifies the zones to output with the zone selection dialog, the zones to be written are similarly updated. This enables the use of Tecplot to create multiple configurations of a geometry being analyzed. For example, if an aircraft is loaded with multiple deflections of flaps, by activating and deactivating different zones for a specific flap setting, new specific configurations of that aircraft can be easily generated by only writing out specific zones. Thus, if ten flap settings are loaded into Tecplot, the PLOT3D Export software can output ten different configurations, one for each flap setting.
Author
Graphical User Interface; Computational Grids; Deactivation; Activation

20100019591 United Space Alliance, Houston, TX, USA
Astronaut Office Scheduling System Software
Brown, Estevancio; NASA Tech Briefs, May 2010; May 2010, pp. 19-20; In English; See also 20100019580
Report No.(s): MSC-24384-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019591; http://www.techbriefs.com/component/content/article/7944

AOSS is a highly efficient scheduling application that uses various tools to schedule astronauts weekly appointment information. This program represents an integration of many technologies into a single application to facilitate schedule sharing and management. It is a Windows-based application developed in Visual Basic. Because the NASA standard office automation load environment is Microsoft-based, Visual Basic provides AO SS developers with the ability to interact with Windows collaboration components by accessing objects models from applications like Outlook and Excel. This also gives developers the ability to create newly customizable components that perform specialized tasks pertaining to scheduling reporting inside the application. With this capability, AOSS can perform various asynchronous tasks, such as gathering/ sending/ managing astronauts schedule information directly to their Outlook calendars at any time.
Author
Astronauts; Schedules; Office Automation; Calendars; Computer Programs; Scheduling

20100019592 California Inst. of Tech., Pasadena, CA, USA

Wavefront Correction for Large, Flexible Antenna Reflector

Imbriale, William A.; Jammejad, Vahraz; FROM; Rajagopalan, Harish; Xu, Shenheng; NASA Tech Briefs, May 2010; May 2010, pp. 11; In English; See also 20100019580

Report No.(s): NPO-46053; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019592; http://www.techbriefs.com/component/content/article/7935

A wavefront-correction system has been proposed as part of an outer-space radio communication system that would include a large, somewhat flexible main reflector antenna, a smaller subreflector antenna, and a small array feed at the focal plane of these two reflector antennas. Part of the wavefront-correction system would reside in the subreflector, which would be a planar patch-element reflectarray antenna in which the phase shifts of the patch antenna elements would be controlled via microelectromechanical systems (MEMS) radio -frequency (RF) switches. The system would include the following sensing-and-computing subsystems: a) An optical photogrammetric subsystem built around two cameras would estimate geometric distortions of the main reflector; b) A second subsystem would estimate wavefront distortions from amplitudes and phases of signals received by the array feed elements; and c) A third subsystem, built around small probes on the subreflector plane, would estimate wavefront distortions from differences among phases of signals received by the probes. The distortion estimates from the three subsystems would be processed to generate control signals to be fed to the MEMS RF switches to correct for the distortions, thereby enabling collimation and aiming of the received or transmitted radio beam to the required precision.

Author

Antenna Arrays; Reflector Antennas; Radio Communication; Wave Fronts; Photogrammetry; Radio Frequencies; Space Communication; Microelectromechanical Systems

20100019593 California Inst. of Tech., Pasadena, CA, USA

Two-Stage, 90-GHz, Low-Noise Amplifier

Samoska, Lorene A.; Gaier, Todd C.; Xenos, Stephanie; Soria, Mary M.; Kangaslahti, Pekka P.; Cleary, Kieran A.; Ferreira, Linda; Lai, Richard; Mei, Xiaobing; NASA Tech Briefs, May 2010; May 2010, pp. 12-13; In English; See also 20100019580

Report No.(s): NPO-46627; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019593; http://www.techbriefs.com/component/content/article/7938

A device has been developed for coherent detection of the polarization of the cosmic microwave background (CMB). A two-stage amplifier has been designed that covers 75-110 GHz. The device uses the emerging 35-nm InP HEMT technology recently developed at Northrop Grumman Corporation primarily for use at higher frequencies. The amplifier has more than 18 dB gain and less than 35 K noise figure across the band. These devices have noise less than 30 K at 100 GHz. The development started with design activities at JPL, as well as characterization of multichip modules using existing InP. Following processing, a test campaign was carried out using single-chip modules at 100 GHz. Successful development of the chips will lead to development of multichip modules, with simultaneous Q and U Stokes parameter detection. This MMIC (monolithic microwave integrated circuit) amplifier takes advantage of performance improvements intended for higher frequencies, but in this innovation are applied at 90 GHz. The large amount of available gain ultimately leads to lower possible noise performance at 90 GHz.

Author

Cosmic Microwave Background Radiation; High Electron Mobility Transistors; Amplifiers; Low Noise; Chips (Electronics); Integrated Circuits; Microwave Circuits

20100019594 California Inst. of Tech., Pasadena, CA, USA

A 311-GHz Fundamental Oscillator Using InP HBT Technology

Gaier, Todd; Fung, King Man; Samoska, Lorene; Radisic, Vesna; Sawdai, Donald; Scott, Dennis; Deal, W.R.; NASA Tech Briefs, May 2010; May 2010, pp. 13; In English; See also 20100019580

Report No.(s): NPO-44968; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019594; http://www.techbriefs.com/component/content/article/7939

This oscillator uses a single-emitter 0.3- m InP heterojunction bipolar transistor (HBT) device with maximum frequency of oscillation (fmax) greater than 500 GHz. Due to high conductor and substrate losses at submillimeterwave frequencies, a primary challenge is to efficiently use the intrinsic device gain. This was done by using a suitable transmission-line media and circuit topology. The passive components of the oscillator are realized in a twometal process with benzocyclobutene (BCB) used as the primary transmission line dielectric. The circuit was designed using microstrip transmission lines. The oscillator is implemented in a common-base topology due to its inherent instability, and the design includes an on-chip resonator,

outputmatching circuitry, and an injection-locking port, the port being used to demonstrate the injection-locking prin ciple. A free-running frequency of 311.6 GHz has been measured by down-converting the signal. Ad di tionally, injection locking has been successfully demonstrated with up to 17.8 dB of injection-locking gain. The injection-locking reference signal is generated using a 2 20 GHz frequency synthesizer, followed by a doubler, active tripler, a W-band amplifier, and then a passive tripler. Therefore, the source frequency is multiplied 18 times to obtain a signal above 300 GHz that can be used to injection lock the oscillator. Measurement shows that injection locking has improved the phase noise of the oscillator and can be also used for synchronizing a series of oscillators. A signal conductor is implemented near the BCP -InP interface and the topside of the BCB layer is fully metallized as a signal ground. Because the fields are primarily constrained in the lower permittivity BCB region, this type of transmission line is referred to as an inverted microstrip. In addition, both common-emitter and commonbase circuits were investigated to determine optimum topology for oscillator design. The common -base topology required smaller amount of feedback than the common-emitter design, therefore preserving device gain, and was chosen for the oscillator design. The submillimeter-wave region offers several advantages for sensors and communication systems, such as high resolution and all-weather imaging due to the short-wavelength, and improved communication speeds by access to greater frequency bandwidth. This oscillator circuit is a prototype of the first HBT oscillator operating above 300 GHz. Additional development is necessary to increase the output power of the circuit for radar and imaging applications.
Author
Bipolar Transistors; Heterojunction Devices; Microwave Oscillators; Submillimeter Waves; Frequency Synthesizers; Imaging Techniques; Microstrip Transmission Lines; Dielectrics; High Resolution

20100019595 California Inst. of Tech., Pasadena, CA, USA
Ceramic Rail-Race Ball Bearings
Balzer, Mark A.; Mungas, Greg S.; Peters, Gregory H.; NASA Tech Briefs, May 2010; May 2010, pp. 27-28; In English; See also 20100019580; Original contains black and white illustrations
Report No.(s): NPO-44908; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019595; http://www.techbriefs.com/component/content/article/7959

Non-lubricated ball bearings featuring rail races have been proposed for use in mechanisms that are required to function in the presence of mineral dust particles in very low-pressure, dry environments with extended life. Like a conventional ball bearing, the proposed bearing would include an inner and an outer ring separated by balls in rolling contact with the races. However, unlike a conventional ball bearing, the balls would not roll in semi-circular or gothic arch race grooves in the rings: instead, the races would be shaped to form two or more rails (see figure). During operation, the motion of the balls would push dust particles into the spaces between the rails where the particles could not generate rolling resistance for the balls
Author
Ball Bearings; Low Pressure; Rails; Grooves; Ceramics; Dust

20100019596 NASA Johnson Space Center, Houston, TX, USA
Math Description Engine Software Development Kit
Shelton, Robert O.; Smith, Stephanie L.; Dexter, Dan E.; Hodgson, Terry R.; NASA Tech Briefs, May 2010; May 2010, pp. 19; In English; See also 20100019580
Report No.(s): MSC-24139-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019596; http://www.techbriefs.com/component/content/article/7943

The Math Description Engine Software Development Kit (MDE SDK) can be used by software developers to make computer-rendered graphs more accessible to blind and visually-impaired users. The MDE SDK generates alternative graph descriptions in two forms: textual descriptions and non-verbal sound renderings, or sonification. It also enables display of an animated trace of a graph sonification on a visual graph component, with color and line-thickness options for users having low vision or color-related impairments. A set of accessible graphical user interface widgets is provided for operation by end users and for control of accessible graph displays. Version 1.0 of the MDE SDK generates text descriptions for 2D graphs commonly seen in math and science curriculum (and practice). The mathematically rich text descriptions can also serve as a virtual math and science assistant for blind and sighted users, making graphs more accessible for everyone. The MDE SDK has a simple application programming interface (API) that makes it easy for programmers and Web-site developers to make graphs accessible with just a few lines of code. The source code is written in Java for cross-platform compatibility and to take advantage of Java s built-in support for building accessible software application interfaces. Compiled-library and NASA Open Source versions are available with API documentation and Programmer s Guide at http:/ / prim e.jsc.n asa. gov.
Author
Engine Design; Application Programming Interface; Display Devices; Education; Graphical User Interface

20100019597 California Univ., San Diego, CA, USA

Non-Geiger-Mode Single-Photon Avalanche Detector with Low Excess Noise

Zhao, Kai; Lo, YuHwa; Farr, William; NASA Tech Briefs, May 2010; May 2010, pp. 32-33; In English; See also 20100019580; Original contains color illustrations

Report No.(s): NPO-45801; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019597; http://www.techbriefs.com/component/content/article/7916

This design constitutes a self-resetting (gain quenching), room-temperature operational semiconductor single-photon-sensitive detector that is sensitive to telecommunications optical wavelengths and is scalable to large areas (millimeter diameter) with high bandwidth and efficiencies. The device can detect single photons at a 1,550-nm wavelength at a gain of 1 x 10(exp 6). Unlike conventional single photon avalanche detectors (SPADs), where gain is an extremely sensitive function to the bias voltage, the multiplication gain of this device is stable at 1 x 10(exp 6) over a wide range of bias from 30.2 to 30.9 V. Here, the multiplication gain is defined as the total number of charge carriers contained in one output pulse that is triggered by the absorption of a single photon. The statistics of magnitude of output signals also shows that the device has a very narrow pulse height distribution, which demonstrates a greatly suppressed gain fluctuation. From the histograms of both pulse height and pulse charge, the equivalent gain variance (excess noise) is between 1.001 and 1.007 at a gain of 1 x 10(exp 6). With these advantages, the device holds promise to function as a PMT-like photon counter at a 1,550- nm wavelength. The epitaxial layer structure of the device allows photons to be absorbed in the InGaAs layer, generating electron/hole (e-h) pairs. Driven by an electrical field in InGaAs, electrons are collected at the anode while holes reach the multiplication region (InAlAs p-i-n structure) and trigger the avalanche process. As a result, a large number of e-h pairs are created, and the holes move toward the cathode. Holes created by the avalanche process gain large kinetic energy through the electric field, and are considered hot. These hot holes are cooled as they travel across a p -InAlAs low field region, and are eventually blocked by energy barriers formed by the InGaAsP/ InAlAs heterojunctions. The composition of the InGaAsP alloy was chosen to have an 80 meV valance band offset with InAlAs, which is high enough to hinder the transport of the already cooled holes. Being stopped by the energy barrier, holes are accumulated at the junctions to shield the electric field, resulting in a decrease of the electric field in the multiplication region. Because the impact ionization rate is extremely sensitive to the magnitude of the electric field, the field-screening effect drastically reduces the impact ionization rate and quenches the output signals. After the avalanche pulse signal is self-quenched, the accumulated holes at the InGaAsP/ InAlAs interface escape the energy barrier through thermal excitation and tunneling and finally leave the device. The device is thus reset and ready for subsequent photon detection. This recovery time is controlled by the height of the energy barrier and the hole-cooling rate.

Author

Heterojunctions; Low Noise; Photons; Indium Gallium Arsenides; Avalanche Diodes; Optical Communication

20100019598 Orion Propulsion, Madison, AL, USA

Gimballing Spacecraft Thruster

Pickens, Tim; Bossard, John; NASA Tech Briefs, May 2010; May 2010, pp. 26; In English; See also 20100019580

Report No.(s): MFS-32520-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019598; http://www.techbriefs.com/component/content/article/7960

A gimballing spacecraft reaction-control-system thruster was developed that consists of a small hydrogen/oxygen-burning rocket engine integrated with a Canfield joint. (Named after its inventor, a Canfield joint is a special gimbal mount that is strong and stable yet allows a wide range of motion.) One especially notable aspect of the design of this thruster is integration, into both the stationary legs and the moving arms of the Canfield joint, of the passages through which the hydrogen and oxygen flow to the engine. The thruster was assembled and subjected to tests in which the engine was successfully fired both with and without motion in the Canfield joint.

Author

Gimbals; Spacecraft Control; Rocket Engines; Hydrogen Engines

20100019599 California Inst. of Tech., Pasadena, CA, USA

Simple Check Valves for Microfluidic Devices

Willis, Peter A.; Greer, Harold F.; Smith, J. Anthony; NASA Tech Briefs, May 2010; May 2010, pp. 24-25; In English; See also 20100019580; Original contains color illustrations

Report No.(s): NPO-45933; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019599; http://www.techbriefs.com/component/content/article/7954

A simple design concept for check valves has been adopted for microfluidic devices that consist mostly of (1) deformable fluorocarbon polymer membranes sandwiched between (2) borosilicate float glass wafers into which channels, valve seats, and

holes have been etched. The first microfluidic devices in which these check valves are intended to be used are micro-capillary electrophoresis (microCE) devices undergoing development for use on Mars in detecting compounds indicative of life. In this application, it will be necessary to store some liquid samples in reservoirs in the devices for subsequent laboratory analysis, and check valves are needed to prevent cross-contamination of the samples. The simple check-valve design concept is also applicable to other microfluidic devices and to fluidic devices in general. These check valves are simplified microscopic versions of conventional rubber- flap check valves that are parts of numerous industrial and consumer products. These check valves are fabricated, not as separate components, but as integral parts of microfluidic devices. A check valve according to this concept consists of suitably shaped portions of a deformable membrane and the two glass wafers between which the membrane is sandwiched (see figure). The valve flap is formed by making an approximately semicircular cut in the membrane. The flap is centered over a hole in the lower glass wafer, through which hole the liquid in question is intended to flow upward into a wider hole, channel, or reservoir in the upper glass wafer. The radius of the cut exceeds the radius of the hole by an amount large enough to prevent settling of the flap into the hole. As in a conventional rubber-flap check valve, back pressure in the liquid pushes the flap against the valve seat (in this case, the valve seat is the adjacent surface of the lower glass wafer), thereby forming a seal that prevents backflow.

Author

Microfluidic Devices; Deformation; Control Valves; Membranes; Fluorocarbons; Fluidics

20100019600 California Inst. of Tech., Pasadena, CA, USA

FPGA Coprocessor Design for an Onboard Multi-Angle Spectro-Polarimetric Imager

Pingree, Paula J.; Werne, Thomas A.; NASA Tech Briefs, May 2010; May 2010, pp. 13-14; In English; See also 20100019580

Report No.(s): NPO-46614; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019600; http://www.techbriefs.com/component/content/article/7940

A multi-angle spectro-polarimetric imager (MSPI) is an advanced camera system currently under development at JPL for possible future consideration on a satellite-based Aerosol-Cloud-Environ - ment (ACE) interaction study. The light in the optical system is subjected to a complex modulation designed to make the overall system robust against many instrumental artifacts that have plagued such measurements in the past. This scheme involves two photoelastic modulators that are beating in a carefully selected pattern against each other. In order to properly sample this modulation pattern, each of the proposed nine cameras in the system needs to read out its imager array about 1,000 times per second. The onboard processing required to compress this data involves least-squares fits (LSFs) of Bessel functions to data from every pixel in realtime, thus requiring an onboard computing system with advanced data processing capabilities in excess of those commonly available for space flight. As a potential solution to meet the MSPI onboard processing requirements, an LSF algorithm was developed on the Xilinx Virtex-4FX60 field programmable gate array (FPGA). In addition to configurable hardware capability, this FPGA includes Power -PC405 microprocessors, which together enable a combination hardware/ software processing system. A laboratory demonstration was carried out based on a hardware/ software co-designed processing architecture that includes hardware-based data collection and least-squares fitting (computationally), and softwarebased transcendental function computation (algorithmically complex) on the FPGA. Initial results showed that these calculations can be handled using a combination of the Virtex- 4TM Power-PC core and the hardware fabric.

Author

Field-Programmable Gate Arrays; Onboard Data Processing; Microprocessors; Data Acquisition; Bessel Functions; Transcendental Functions; Real Time Operation; Systems Engineering; Cameras

20100019601 California Inst. of Tech., Pasadena, CA, USA

Novel Micro Strip-to-Waveguide Feed Employing a Double-Y Junction

Venkatesan, Jaikrishina; NASA Tech Briefs, May 2010; May 2010, pp. 11-12; In English; See also 20100019580; Original contains color illustrations

Report No.(s): NPO-42667; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019601; http://www.techbriefs.com/component/content/article/7936

Previous micro strip -to -waveguide transitions either required a hermetically sealed waveguide configuration, or a balun that needed to be tuned according to the frequency band of interest. In this design, the balun is realized using a double -Y junction to transition from microstrip to coplanar strip feeding a quasi-Yagi dipole array (see figure). The length of the feed (Lf) extending into the waveguide is 15.54 mm. The length of the ground plane below the ULTRALAM substrate is 7.75 mm. The lengths L1 , L2, and L3 are 8.50 mm, 4.38 mm, and 2.14 mm, respectively. These lengths were computed via a preliminary optimization aimed at improving the return loss at the band edges. The waveguide feed was designed to excite the TE10 mode in a WR-90 waveguide, and to operate over the recommended frequencies of 8.2 to 12.4 GHz. The feed employs a Rogers

6010 substrate (dielectric constant Er approx. equals 10.2) bonded with a Rogers ULTRALAM substrate (Er approx. equals 2.5). The ULTRALAM substrate serves to provide mechanical strength for 6010 substrate, and to mitigate loses due to parasitic modes (the ground plane is etched on the bottom of this layer due to the topology of the double -Y balun). The double-Y balun transitioning from an unbalanced microstrip line to a balanced coplanar strip (CPS) line does not provide inherent impedance transformation; hence, Klopfenstein impedance tapers were synthesized to transition from 50 to 77 Ohms in the microstrip section and from 77 to 110 Ohms in the CPS section. At the balun junction, the CPS stub lengths were chosen such that the X/ 8 resonance is pushed outside the bandwidth of operation. Also, the smallest allowable conductor width and gap spacing were chosen to meet acceptable manufacturing tolerances.
Author
Microstrip Transmission Lines; Waveguides; Yagi Antennas; Impedance; Planar Structures; Conductors; Frequencies; Etching

20100019602 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Instrument for Analysis of Greenland's Glacier Mills
Behar, Alberto E.; Matthews, Jaret B.; Tran, Hung B.; Steffen, Konrad; McGrath, Dan; Phillips, Thomas; Elliot, Andrew; OHern, Sean; Lutz, Colin; Martin, Sujita; Wang, Henry; NASA Tech Briefs, May 2010; May 2010, pp. 5; In English; See also 20100019580
Report No.(s): NPO-46514; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019602; http://www.techbriefs.com/component/content/article/7933

A new instrument is used to study the inner workings of Greenland s glacier mills by riding the currents inside a glacier s moulin. The West Greenland Moulin Explorer instrument was deployed into a tubular shaft to autonomously record temperature, pressure, 3D acceleration, and location. It is built with a slightly positive buoyancy in order to assist in recovery. The unit is made up of several components. A 3-axis MEMS (microelectromechanical systems) accelerometer with 0.001-g resolution forms the base of the unit. A pressure transducer is added that is capable of withstanding 500 psi (=3.4 MPa), and surviving down to -40 C. An Iridium modem sends out data every 10 minutes. The location is traced by a GPS (Global Positioning System) unit. This GPS unit is also used for recovery after the mission. Power is provided by a high-capacity lithium thionyl chloride D-sized battery. The accelerometer is housed inside a cylindrical, foot-long (=30 cm) polyvinyl chloride (PVC) shell sealed at each end with acrylic. The pressure transducer is attached to one of these lids and a MEMS accelerometer to the other, recording 100 samples per second per axis.
Author
Glaciers; Microelectromechanical Systems; Global Positioning System; Pressure Sensors; Cylindrical Bodies

20100019603 NASA Glenn Research Center, Cleveland, OH, USA
Thin-Film Ferro Electric-Coupled Microstripline Phase Shifters With Reduced Device Hysteresis
Miranda, Felix A.; Romanofsky, Robert; Mueller, Carl H.; VanKeuls, Frederick; NASA Tech Briefs, May 2010; May 2010, pp. 12; In English; See also 20100019580
Report No.(s): LEW-18370-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019603; http://www.techbriefs.com/component/content/article/7937

This work deals with the performance of coupled microstripline phase shifters (CMPS) fabricated using BaxSr 1 -xTiO 3 (BST) ferroelectric thin films. The CMPS were fabricated using commercially available pulsed laser deposition BST films with Ba:Sr ratios of 30:70 and 20:80. Microwave characterization of these CMPS was performed at upper Kuband frequencies, particularly at frequencies near 16 and 18 GHz. X-ray diffraction studies indicate that the 30:70 films exhibit almost a 1:1 ratio between the in-plane and out-of-plane lattice parameters, suggesting that their cubics create strain -free films suitable for producing CMPS devices with reduced hysteresis in the paraelectric state. The quality of performance of the CMPS was studied based on their relative phase shift and insertion loss within the DC bias range of 0 to 400 V (i.e., E-field ranges within 0 to 53 V/micron). The performance of the CMPS was tested as a function of temperature to investigate their operation in the paraelectric, as well as in the ferroelectric, state (i.e., above and below the Curie temperature, respectively). The novel behavior discussed here is based on the experimental observation of the CMPS. This behavior, observed for the aforementioned cation ratio, highlights the relevance of good crystalline structure for high-quality CMPS.
Author
Phase Shift; Ferroelectricity; Insertion Loss; Pulsed Laser Deposition; X Ray Diffraction; Thin Films; Crystallinity; Microwaves

20100019604 California Inst. of Tech., Pasadena, CA, USA

Improved OTEC System for a Submarine Robot

Chao, Yi; Jones, Jack; Valdez, Thomas; NASA Tech Briefs, May 2010; May 2010, pp. 29-30; In English; See also 20100019580; Original contains color illustrations

Report No.(s): NPO-45404; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019604; http://www.techbriefs.com/component/content/article/7961

An ocean thermal energy conversion (OTEC), now undergoing development, is a less-massive, more-efficient means of exploiting the same basic principle as that of the proposed system described in 'Alternative OTEC Scheme for a Submarine Robot' (NPO-43500), NASA Tech Briefs, Vol. 33, No. 1 (January 2009), page 50. The proposed system as described previously would be based on the thawing-expansion/freezing-contraction behavior of a wax or perhaps another suitable phase-change material (PCM). The power generated by the system would be used to recharge the batteries in a battery-powered unmanned underwater vehicle [UUV (essentially, a small exploratory submarine robot)] of a type that has been deployed in large numbers in research pertaining to global warming. A UUV of this type travels between the ocean surface and depths, measuring temperature and salinity. At one phase of its operational cycle, the previously proposed system would utilize the surface ocean temperature (which lies between 15 and 30 C over most of the Earth) to melt a PCM that has a melting/freezing temperature of about 10 C. At the opposite phase of its operational cycle, the system would utilize the lower ocean temperature at depth (e.g., between 4 and 7 C at a depth of 300 m) to freeze the PCM. The melting or freezing would cause the PCM to expand or contract, respectively, by about 9 volume percent. The PCM would be contained in tubes that would be capable of expanding and contracting with the PCM. The PCM-containing tubes would be immersed in a hydraulic fluid. The expansion and contraction would drive a flow of the hydraulic fluid against a piston that, in turn, would push a rack-and-pinion gear system to spin a generator to charge a battery.

Author

Robots; Ocean Thermal Energy Conversion; Temperature Measurement; Underwater Vehicles; Ocean Surface; Freezing; Melting; Hydraulic Fluids

20100019605 California Inst. of Tech., Pasadena, CA, USA

Planar Submillimeter-Wave Mixer Technology with Integrated Antenna

Chattopadhyay, Gautam; Mehdi, Imran; Gill, John J.; Lee, Choonsup; lombart, Muria L.; Thomas, Betrand; NASA Tech Briefs, May 2010; May 2010, pp. 31; In English; See also 20100019580

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High-performance mixers at terahertz frequencies require good matching between the coupling circuits such as antennas and local oscillators and the diode embedding impedance. With the availability of amplifiers at submillimeter wavelengths and the need to have multi-pixel imagers and cameras, planar mixer architecture is required to have an integrated system. An integrated mixer with planar antenna provides a compact and optimized design at terahertz frequencies. Moreover, it leads to a planar architecture that enables efficient interconnect with submillimeter-wave amplifiers. In this architecture, a planar slot antenna is designed on a thin gallium arsenide (GaAs) membrane in such a way that the beam on either side of the membrane is symmetric and has good beam profile with high coupling efficiency. A coplanar waveguide (CPW) coupled Schottky diode mixer is designed and integrated with the antenna. In this architecture, the local oscillator (LO) is coupled through one side of the antenna and the RF from the other side, without requiring any beam sp litters or diplexers. The intermediate frequency (IF) comes out on a 50-ohm CPW line at the edge of the mixer chip, which can be wire-bonded to external circuits. This unique terahertz mixer has an integrated single planar antenna for coupling both the radio frequency (RF) input and LO injection without any diplexer or beamsplitters. The design utilizes novel planar slot antenna architecture on a 3- mthick GaAs membrane. This work is required to enable future multi-pixel terahertz receivers for astrophysics missions, and lightweight and compact receivers for planetary missions to the outer planets in our solar system. Also, this technology can be used in tera hertz radar imaging applications as well as for testing of quantum cascade lasers (QCLs).

Author

Astrophysics; Submillimeter Waves; Antenna Couplers; Beam Splitters; Planar Structures; Design Analysis; Imaging Techniques; Slot Antennas; Systems Integration

20100019606 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Crossed, Small-Deflection Energy Analyzer for Wind/Temperature Spectrometer

Herrero, Federico A.; Finne, Theodore T.; NASA Tech Briefs, May 2010; May 2010, pp. 8-9; In English; See also 20100019580; Original contains color illustrations

Report No.(s): GSC-15732-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019606; http://www.techbriefs.com/component/content/article/7929

Determination of neutral winds and ion drifts in low-Earth-orbit missions requires measurements of the angular and energy distributions of the flux of neutrals and ions entering the satellite from the ram direction. The magnitude and direction of the neutral-wind (or ion-drift) determine the location of the maximum in the angular distribution of the flux. Knowledge of the angle of maximum flux with respect to satellite coordinates (pointing) is essential to determine the wind (or ion-drift) vector. The crossed Small-Deflection Energy Analyzer (SDEA) spectrometer (see Figure 1) occupies minimal volume and consumes minimal power. Designed for upper atmosphere/ionosphere investigations at Earth altitudes above 100 km, the spectrometer operates by detecting the angular and energy distributions of neutral atoms/molecules and ions in two mutually perpendicular planes. In this configuration, the two detection planes actually cross at the spectrometer center. It is possible to merge two SDEAs so they share a common optical axis and alternate measurements between two perpendicular planes, and reduce the number of ion sources from two to one. This minimizes the volume and footprint significantly and reduces the ion source power by a factor of two. The area of the entrance aperture affects the number of ions detected/second and also determines the energy resolution. Thermionic emitters require heater power of about 100 mW to produce 1 mA of electron beam current. Typically, electron energy is about 100 eV and requires a 100-V supply for electron acceleration to supply an additional 100 mW of power. Thus, ion source power is at most 200 mW. If two ion sources were to be used, the ion source power would be, at most, 400 mW. Detector power, deflection voltage power, and microcontroller and other functions require less than 150 mW. A WTS (wind/ temperature spectrometer) with two separate optical axes would consume about 650 mW, while the crossed SDEA described here consumes about 350 mW. The entrance aperture has a diameter of 0.004 in. (0.10 mm) to provide the required energy resolution between 0.05 and 0.15. This design (see Figure 2) provides a WTS occupying a volume less than 40 cm(sup 3), on a footprint of diameter about 1.5 in. (38 mm). The Crossed SDEA offers many advantages in the measurements of neutral wind and ion drifts in the Earth's thermosphere. As such, it will be useful in future commercial satellites dedicated to monitoring the ionosphere with a view to improving the integrity and predictability of GPS operations. Author

Deflection; Energy Distribution; Low Earth Orbits; Neutral Atmospheres; Spectrometers; Winds Aloft; Analyzers

20100019607 Sierra Engineering, Inc., USA

Triaxial Swirl Injector Element for Liquid-Fueled Engines

Muss, Jeff; NASA Tech Briefs, May 2010; May 2010, pp. 16-17; In English; See also 20100019580

Report No.(s): MFS-32717-1; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019607; http://www.techbriefs.com/component/content/article/7951

A triaxial injector is a single bi-propellant injection element located at the center of the injector body. The injector element consists of three nested, hydraulic swirl injectors. A small portion of the total fuel is injected through the central hydraulic injector, all of the oxidizer is injected through the middle concentric hydraulic swirl injector, and the balance of the fuel is injected through an outer concentric injection system. The configuration has been shown to provide good flame stabilization and the desired fuel-rich wall boundary condition. The injector design is well suited for preburner applications. Preburner injectors operate at extreme oxygen-to-fuel mass ratios, either very rich or very lean. The goal of a preburner is to create a uniform drive gas for the turbomachinery, while carefully controlling the temperature so as not to stress or damage turbine blades. The triaxial injector concept permits the lean propellant to be sandwiched between two layers of the rich propellant, while the hydraulic atomization characteristics of the swirl injectors promote interpropellant mixing and, ultimately, good combustion efficiency. This innovation is suited to a wide range of liquid oxidizer and liquid fuels, including hydrogen, methane, and kerosene. Prototype testing with the triaxial swirl injector demonstrated excellent injector and combustion chamber thermal compatibility and good combustion performance, both at levels far superior to a pintle injector. Initial testing with the prototype injector demonstrated over 96-percent combustion efficiency. The design showed excellent high -frequency combustion stability characteristics with oxygen and kerosene propellants. Unlike the more conventional pintle injector, there is not a large bluff body that must be cooled. The absence of a protruding center body enhances the thermal durability of the triaxial swirl injector. The hydraulic atomization characteristics of the innovation allow the design to be rapidly scaled from small in-space applications [500-5,000 lbf (2.2 22.2 kN)] to large thrust engine applications [80,000 lbf (356 kN) and beyond]. The triaxial injector is also less sensitive to eccentricities, manufacturing tolerances, and gap width of many traditional coaxial and pintle injector designs. The triaxial-injector injection orifice configuration provides for high injection stiffness. The low

parts count and relatively large injector design features are amenable to low-cost production.
Author
Injectors; Liquid Fuels; Engine Design; Turbomachinery; Bluff Bodies; Liquid Oxidizers; Triaxial Stresses; Swirling

20100019608 NASA Glenn Research Center, Cleveland, OH, USA
Probabilistic Structural Analysis Program
Pai, Shantaram S.; Chamis, Christos C.; Murthy, Pappu L. N.; Stefko, George L.; Riha, David S.; Thacker, Ben H.; Nagpal, Vinod K.; Mital, Subodh K.; NASA Tech Briefs, May 2010; May 2010, pp. 20; In English; See also 20100019580
Report No.(s): EW-18229-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019608; http://www.techbriefs.com/component/content/article/7946

NASA/NESSUS 6.2c is a general-purpose, probabilistic analysis program that computes probability of failure and probabilistic sensitivity measures of engineered systems. Because NASA/NESSUS uses highly computationally efficient and accurate analysis techniques, probabilistic solutions can be obtained even for extremely large and complex models. Once the probabilistic response is quantified, the results can be used to support risk-informed decisions regarding reliability for safety-critical and one-of-a-kind systems, as well as for maintaining a level of quality while reducing manufacturing costs for larger-quantity products. NASA/NESSUS has been successfully applied to a diverse range of problems in aerospace, gas turbine engines, biomechanics, pipelines, defense, weaponry, and infrastructure. This program combines state-of-the-art probabilistic algorithms with general-purpose structural analysis and lifting methods to compute the probabilistic response and reliability of engineered structures. Uncertainties in load, material properties, geometry, boundary conditions, and initial conditions can be simulated. The structural analysis methods include non-linear finite-element methods, heat-transfer analysis, polymer/ceramic matrix composite analysis, monolithic (conventional metallic) materials life-prediction methodologies, boundary element methods, and user-written subroutines. Several probabilistic algorithms are available such as the advanced mean value method and the adaptive importance sampling method. NASA/NESSUS 6.2c is structured in a modular format with 15 elements.
Author
Prediction Analysis Techniques; Probability Theory; Structural Analysis; Failure; Finite Element Method; Heat Transfer; Reliability; Ceramic Matrix Composites; Polymer Matrix Composites; Loads (Forces)

20100019609 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Turbomolecular Pumps for Holding Gases in Open Containers
Keller, John W.; Lorenz, John E.; NASA Tech Briefs, May 2010; May 2010, pp. 16; In English; See also 20100019580; Original contains color illustrations
Report No.(s): GSC-14402-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019609; http://www.techbriefs.com/component/content/article/7949

Proposed special-purpose turbomolecular pumps denoted turbotraps would be designed, along with mating open containers, to prevent the escape of relatively slowly (thermal) moving gas molecules from the containers while allowing atoms moving at much greater speeds to pass through. In the original intended applications, the containers would be electron-attachment cells, and the contained gases would be vapors of alkali metal atoms moving at thermal speeds that would be of the order of a fraction of 300 meters per second. These cells would be parts of apparatuses used to measure fluxes of neutral atoms incident at kinetic energies in the approximate range of 10 eV to 10 keV (corresponding to typical speeds of the order of 40,000 m/s and higher). The incident energetic neutral atoms would pass through the cells, wherein charge-exchange reactions with the alkali metal atoms would convert the neutral atoms to negative ions, which, in turn, could then be analyzed by use of conventional charged-particle optics.
Derived from text
Turbine Pumps; Gases; Containers; Alkali Metals; Neutral Atoms

20100019610 Alabama Univ., AL, USA
Integrated Hybrid System Architecture for Risk Analysis
Moynihan, Gary P.; Fonseca, Daniel J.; Ray, Paul S.; NASA Tech Briefs, May 2010; May 2010, pp. 21; In English; See also 20100019580
Report No.(s): MSC-23809-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019610; http://www.techbriefs.com/component/content/article/7948

A conceptual design has been announced of an expert-system computer program, and the development of a prototype of

the program, intended for use as a project-management tool. The program integrates schedule and risk data for the purpose of determining the schedule applications of safety risks and, somewhat conversely, the effects of changes in schedules on changes on safety. It is noted that the design has been delivered to a NASA client and that it is planned to disclose the design in a conference presentation.
Derived from text
Architecture (Computers); Expert Systems; Risk Assessment; Systems Integration; Project Management

20100019611 ASRC Aerospace Corp., Cocoa Beach, FL, USA
Low-Dead-Volume Inlet for Vacuum Chamber
Naylor, Guy; Arkin, C.; NASA Tech Briefs, May 2010; May 2010, pp. 24; In English; See also 20100019580
Report No.(s): KSC-13317; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019611; http://www.techbriefs.com/component/content/article/7955

Gas introduction from near-ambient pressures to high vacuum traditionally is accomplished either by multi-stage differential pumping that allows for very rapid response, or by a capillary method that allows for a simple, single-stage introduction, but which often has a delayed response. Another means to introduce the gas sample is to use the multi-stage design with only a single stage. This is accomplished by using a very small conductance limit. The problem with this method is that a small conductance limit will amplify issues associated with dead -volume. As a result, a high -vacuum gas inlet was developed with low dead -volume, allowing the use of a very low conductance limit interface. Gas flows through the ConFlat flange at a relatively high flow rate at orders of magnitude greater than through the conductance limit. The small flow goes through a conductance limit that is a double-sided ConFlat.
Author
Gas Flow; High Vacuum; Flow Velocity; Low Vacuum; Vacuum Chambers; Gas Pressure

20100019612 California Univ., Los Angeles, CA, USA
Serrating Nozzle Surfaces for Complete Transfer of Droplets
Kim, Chang-Jin 'CJ'; Yi, Uichong; NASA Tech Briefs, May 2010; May 2010, pp. 15; In English; See also 20100019580; Original contains color illustrations
Report No.(s): ARC-15548-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019612; http://www.techbriefs.com/component/content/article/7950

A method of ensuring the complete transfer of liquid droplets from nozzles in microfluidic devices to nearby surfaces involves relatively simple geometric modification of the nozzle surfaces. The method is especially applicable to nozzles in print heads and similar devices required to dispense liquid droplets having precise volumes. Examples of such devices include heads for soft printing of ink on paper and heads for depositing droplets of deoxyribonucleic acid (DNA) or protein solutions on glass plates to form microarrays of spots for analysis. The main purpose served by the present method is to ensure that droplets transferred from a nozzle have consistent volume, as needed to ensure accuracy in microarray analysis or consistent appearance of printed text and images. In soft printing, droplets having consistent volume are generated inside a print head, but in the absence of the present method, the consistency is lost in printing because after each printing action (in which a drop is ejected from a nozzle), a small residual volume of liquid remains attached to the nozzle. By providing for complete transfer of droplets (and thus eliminating residual liquid attached to the nozzle) the method ensures consistency of volume of transferred droplets. An additional benefit of elimination of residue is prevention of cross-contamination among different liquids printed through the same nozzle a major consideration in DNA microarray analysis. The method also accelerates the printing process by minimizing the need to clean a printing head to prevent cross-contamination. Soft printing involves a hydrophobic nozzle surface and a hydrophilic print surface. When the two surfaces are brought into proximity such that a droplet in the nozzle makes contact with the print surface, a substantial portion of the droplet becomes transferred to the print surface. Then as the nozzle and the print surface are pulled apart, the droplet is pulled apart and most of the droplet remains on the print surface. The basic principle of the present method is to reduce the liquid-solid surface energy of the nozzle to a level sufficiently below the intrinsic solid-liquid surface energy of the nozzle material so that the droplet is not pulled apart and, instead, the entire droplet volume becomes transferred to the print surface. In this method, the liquid-solid surface energy is reduced by introducing artificial surface roughness in the form of micromachined serrations on the inner nozzle surface (see figure). The method was tested in experiments on soft printing of DNA solutions and of deionized water through 0.5-mm-diameter nozzles, of which some were not serrated, some were partially serrated, and some were fully serrated. In the nozzles without serrations, transfer was incomplete; that is, residual liquids remained in the nozzles after printing. However,

in every nozzle in which at least half the inner surface was serrated, complete transfer of droplets to the print surface was achieved.
Author
Surface Roughness; Drops (Liquids); Liquid Surfaces; Nozzles; Deionization; Microfluidic Devices; Hydrophobicity; Deoxyribonucleic Acid; Surface Energy; Micromachining

20100019613 NASA Johnson Space Center, Houston, TX, USA
Integrated Budget Office Toolbox
Rushing, Douglas A.; Blakeley, Chris; Chapman, Gerry; Robertson, Bill; Horton, Allison; Besser, Thomas; McCarthy, Debbie; NASA Tech Briefs, May 2010; May 2010, pp. 19; In English; See also 20100019580
Report No.(s): MSC-24167-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019613; http://www.techbriefs.com/component/content/article/7941

The Integrated Budget Office Toolbox (IBOT) combines budgeting, resource allocation, organizational funding, and reporting features in an automated, integrated tool that provides data from a single source for Johnson Space Center (JSC) personnel. Using a common interface, concurrent users can utilize the data without compromising its integrity. IBOT tracks planning changes and updates throughout the year using both phasing and POP-related (program-operating-plan-related) budget information for the current year, and up to six years out. Separating lump-sum funds received from HQ (Headquarters) into separate labor, travel, procurement, Center G&A (general & administrative), and servicepool categories, IBOT creates a script that significantly reduces manual input time. IBOT also manages the movement of travel and procurement funds down to the organizational level and, using its integrated funds management feature, helps better track funding at lower levels. Third-party software is used to create integrated reports in IBOT that can be generated for plans, actuals, funds received, and other combinations of data that are currently maintained in the centralized format. Based on Microsoft SQL, IBOT incorporates generic budget processes, is transportable, and is economical to deploy and support.
Author
Budgeting; Project Planning; Resource Allocation; Automatic Control

20100019614 California Inst. of Tech., Pasadena, CA, USA
Reactive Collision Avoidance Algorithm
Scharf, Daniel; Acikmese, Behcet; Ploen, Scott; Hadaegh, Fred; NASA Tech Briefs, May 2010; May 2010, pp. 37; In English; See also 20100019580
Report No.(s): NPO-44771; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019614; http://www.techbriefs.com/component/content/article/7965

The reactive collision avoidance (RCA) algorithm allows a spacecraft to find a fuel-optimal trajectory for avoiding an arbitrary number of colliding spacecraft in real time while accounting for acceleration limits. In addition to spacecraft, the technology can be used for vehicles that can accelerate in any direction, such as helicopters and submersibles. In contrast to existing, passive algorithms that simultaneously design trajectories for a cluster of vehicles working to achieve a common goal, RCA is implemented onboard spacecraft only when an imminent collision is detected, and then plans a collision avoidance maneuver for only that host vehicle, thus preventing a collision in an off-nominal situation for which passive algorithms cannot. An example scenario for such a situation might be when a spacecraft in the cluster is approaching another one, but enters safe mode and begins to drift. Functionally, the RCA detects colliding spacecraft, plans an evasion trajectory by solving the Evasion Trajectory Problem (ETP), and then recovers after the collision is avoided. A direct optimization approach was used to develop the algorithm so it can run in real time. In this innovation, a parameterized class of avoidance trajectories is specified, and then the optimal trajectory is found by searching over the parameters. The class of trajectories is selected as bang-off-bang as motivated by optimal control theory. That is, an avoiding spacecraft first applies full acceleration in a constant direction, then coasts, and finally applies full acceleration to stop. The parameter optimization problem can be solved offline and stored as a look-up table of values. Using a look-up table allows the algorithm to run in real time. Given a colliding spacecraft, the properties of the collision geometry serve as indices of the look-up table that gives the optimal trajectory. For multiple colliding spacecraft, the set of trajectories that avoid all spacecraft is rapidly searched on-line. The optimal avoidance trajectory is implemented as a receding-horizon model predictive control law. Therefore, at each time step, the optimal avoidance trajectory is found and the first time step of its acceleration is applied. At the next time step of the control computer, the problem is re-solved and the new first time step is again applied. This continual updating allows the RCA algorithm to adapt to a colliding spacecraft that is making erratic course changes.
Derived from text
Algorithms; Collision Avoidance; Control Theory; Optimal Control; Reactivity

20100019615 California Inst. of Tech., Pasadena, CA, USA

A Transportable Gravity Gradiometer Based on Atom Interferometry

Yu, Nan; Thompson, Robert J.; Kellogg, James R.; Aveline, David C.; Maleki, Lute; Kohel, James M.; NASA Tech Briefs, May 2010; May 2010, pp. 6-7; In English; See also 20100019580; Original contains color illustrations

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A transportable atom interferometer-based gravity gradiometer has been developed at JPL to carry out measurements of Earth's gravity field at ever finer spatial resolutions, and to facilitate high-resolution monitoring of temporal variations in the gravity field from ground- and flight-based platforms. Existing satellite-based gravity missions such as CHAMP and GRACE measure the gravity field via precise monitoring of the motion of the satellites; i.e. the satellites themselves function as test masses. JPL's quantum gravity gradiometer employs a quantum phase measurement technique, similar to that employed in atomic clocks, made possible by recent advances in laser cooling and manipulation of atoms. This measurement technique is based on atomwave interferometry, and individual laser-cooled atoms are used as drag-free test masses. The quantum gravity gradiometer employs two identical atom interferometers as precision accelerometers to measure the difference in gravitational acceleration between two points (Figure 1). By using the same lasers for the manipulation of atoms in both interferometers, the accelerometers have a common reference frame and non-inertial accelerations are effectively rejected as common mode noise in the differential measurement of the gravity gradient. As a result, the dual atom interferometer-based gravity gradiometer allows gravity measurements on a moving platform, while achieving the same long-term stability of the best atomic clocks. In the laboratory-based prototype (Figure 2), the cesium atoms used in each atom interferometer are initially collected and cooled in two separate magneto-optic traps (MOTs). Each MOT, consisting of three orthogonal pairs of counter-propagating laser beams centered on a quadrupole magnetic field, collects up to 10(exp 9) atoms. These atoms are then launched vertically as in an atom fountain by switching off the magnetic field and introducing a slight frequency shift between pairs of lasers to create a moving rest frame for the trapped atoms. While still in this moving-frame molasses, the laser frequencies are further detuned from the atomic resonance (while maintaining this relative frequency shift) to cool the atom cloud's temperature to 2 K or below, corresponding to an rms velocity of less than 2 cm/s. After launch, the cold atoms undergo further state and velocity selection to prepare for atom interferometry. The atom interferometers are then realized using laser-induced stimulated Raman transitions to perform the necessary manipulations of each atom, and the resulting interferometer phase is measured using laser-induced fluorescence for state-normalized detection. More than 20 laser beams with independent controls of frequency, phase, and intensity are required for this measurement sequence. This instrument can facilitate the study of Earth's gravitational field from surface and air vehicles, as well as from space by allowing gravity mapping from a low-cost, single spacecraft mission. In addition, the operation of atom interferometer-based instruments in space offers greater sensitivity than is possible in terrestrial instruments due to the much longer interrogation times available in the microgravity environment. A space-based quantum gravity gradiometer has the potential to achieve sensitivities similar to the GRACE mission at long spatial wavelengths, and will also have resolution similar to GOCE for measurement at shorter length scales.

Derived from text

Earth Gravitation; Grace Mission; Gravity Gradiometers; Interferometry

20100019616 California Inst. of Tech., Pasadena, CA, USA

Fast Solution in Sparse LDA for Binary Classification

Moghaddam, Baback; NASA Tech Briefs, May 2010; May 2010, pp. 37-38; In English; See also 20100019580

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ONLINE: http://hdl.handle.net/2060/20100019616; http://www.techbriefs.com/component/content/article/7969

An algorithm that performs sparse linear discriminant analysis (Sparse-LDA) finds near-optimal solutions in far less time than the prior art when specialized to binary classification (of 2 classes). Sparse-LDA is a type of feature- or variable- selection problem with numerous applications in statistics, machine learning, computer vision, computational finance, operations research, and bio-informatics. Because of its combinatorial nature, feature- or variable-selection problems are NP-hard or computationally intractable in cases involving more than 30 variables or features. Therefore, one typically seeks approximate solutions by means of greedy search algorithms. The prior Sparse-LDA algorithm was a greedy algorithm that considered the best variable or feature to add/ delete to/ from its subsets in order to maximally discriminate between multiple classes of data. The present algorithm is designed for the special but prevalent case of 2-class or binary classification (e.g. 1 vs. 0, functioning vs. malfunctioning, or change versus no change). The present algorithm provides near-optimal solutions on large real-world datasets having hundreds or even thousands of variables or features (e.g. selecting the fewest wavelength bands in a hyperspectral sensor to do terrain classification) and does so in typical computation times of minutes as compared to days or

weeks as taken by the prior art. Sparse LDA requires solving generalized eigenvalue problems for a large number of variable subsets (represented by the submatrices of the input within-class and between-class covariance matrices). In the general (fullrank) case, the amount of computation scales at least cubically with the number of variables and thus the size of the problems that can be solved is limited accordingly. However, in binary classification, the principal eigenvalues can be found using a special analytic formula, without resorting to costly iterative techniques. The present algorithm exploits this analytic form along with the inherent sequential nature of greedy search itself. Together this enables the use of highly-efficient partitioned-matrix-inverse techniques that result in large speedups of computation in both the forward-selection and backward-elimination stages of greedy algorithms in general.
Author
Discriminant Analysis (Statistics); Linearity; Greedy Algorithms; Classifications; Covariance

20100019617 Rice Univ., Houston, TX, USA
Widely Tunable Mode-Hop-Free External-Cavity Quantum Cascade Laser
Wysocki, Gerard; Curl, Robert F.; Tittel, Frank K.; NASA Tech Briefs, May 2010; May 2010, pp. 32; In English; See also 20100019580
Report No.(s): MSC-24486-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019617; http://www.techbriefs.com/component/content/article/7915

The external-cavity quantum cascade laser (EC-QCL) system is based on an optical configuration of the Littrow type. It is a room-temperature, continuous wave, widely tunable, mode-hop-free, mid-infrared, EC-QCL spectroscopic source. It has a single-mode tuning range of 155 cm(exp -1) (approximately equal to 8% of the center wavelength) with a maximum power of 11.1 mW and 182 cm(exp -1) (approximately equal to 15% of the center wavelength), and a maximum power of 50 mW as demonstrated for 5.3 micron and 8.4 micron EC-QCLs, respectively. This technology is particularly suitable for high-resolution spectroscopic applications, multi-species tracegas detection, and spectroscopic measurements of broadband absorbers. Wavelength tuning of EC-QCL spectroscopic source can be implemented by varying three independent parameters of the laser: (1) the optical length of the gain medium (which, in this case, is equivalent to QCL injection current modulation), (2) the length of the EC (which can be independently varied in the Rice EC-QCL setup), and (3) the angle of beam incidence at the diffraction grating (frequency tuning related directly to angular dispersion of the grating). All three mechanisms of frequency tuning have been demonstrated and are required to obtain a true mode-hop-free laser frequency tuning. The precise frequency tuning characteristics of the EC-QCL output have been characterized using a variety of diagnostic tools available at Rice University (e.g., a monochromator, FTIR spectrometer, and a Fabry-Perot spectrometer). Spectroscopic results were compared with available databases (such as HITRAN, PNNL, EPA, and NIST). These enable precision verification of complete spectral parameters of the EC-QCL, such as wavelength, tuning range, tuning characteristics, and line width. The output power of the EC-QCL is determined by the performance of the QC laser chip, its operating conditions, and parameters of the QC laser cavity such as mirror reflectivity or intracavity losses. In order to maximize the output power, an analysis and optimization of the EC laser parameters has been performed. The parameters of the beam emitted from the gain medium, such as divergence angle, beam profile, and astigmatism, have been investigated. The gain medium has been fully characterized before and after each stage of modification. The main modification steps are coating one facet of the gain chip with a high reflectivity mirror and the other facet with an anti-reflection layer. Then the chip is mounted in the EC-QCL. The optomechanical design has been reviewed and improved to provide for precise collimation of the strongly divergent beam of the QCL and the tuning diffraction grating.
Author
Laser Cavities; Quantum Cascade Lasers; Tunable Lasers; Chips (Electronics); Spectrum Analysis

20100019618 NASA Ames Research Center, Moffett Field, CA, USA
Simplified Night Sky Display System
Castellano, Timothy P.; NASA Tech Briefs, May 2010; May 2010, pp. 39-40; In English; See also 20100019580
Report No.(s): ARC-15437-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019618; http://www.techbriefs.com/component/content/article/7972

A document describes a simple night sky display system that is portable, lightweight, and includes, at most, four components in its simplest configuration. The total volume of this system is no more than 10(sup 6) cm(sup 3) in a disassembled state, and weighs no more than 20 kilograms. The four basic components are a computer, a projector, a spherical light-reflecting first surface and mount, and a spherical second surface for display. The computer has temporary or permanent memory that contains at least one signal representing one or more images of a portion of the sky when viewed from an arbitrary position, and at a selected time. The first surface reflector is spherical and receives and reflects the image from the

projector onto the second surface, which is shaped like a hemisphere. This system may be used to simulate selected portions of the night sky, preserving the appearance and kinesthetic sense of the celestial sphere surrounding the Earth or any other point in space. These points will then show motions of planets, stars, galaxies, nebulae, and comets that are visible from that position. The images may be motionless, or move with the passage of time. The array of images presented, and vantage points in space, are limited only by the computer software that is available, or can be developed. An optional approach is to have the screen (second surface) self-inflate by means of gas within the enclosed volume, and then self-regulate that gas in order to support itself without any other mechanical support.
Author
Night Sky; Portable Equipment; Computer Programs; Display Devices

20100019619 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Cryogenic Moisture Apparatus
Fesmire, James; Smith, Trent; Breakfield, Robert; Baughner, Kevin; Heckle, Kenneth; Meneghelli, Barry; NASA Tech Briefs, May 2010; May 2010, pp. 5-6; In English; See also 20100019580; Original contains color illustrations
Report No.(s): KSC-13049; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019619; http://www.techbriefs.com/component/content/article/7931

The Cryogenic Moisture Apparatus (CMA) is designed for quantifying the amount of moisture from the surrounding air that is taken up by cryogenic-tank-insulating material specimens while under typical conditions of use. More specifically, the CMA holds one face of the specimen at a desired low temperature (e.g., the typical liquid-nitrogen temperature of 77 K) while the opposite face remains exposed to humid air at ambient or near-ambient temperature. The specimen is weighed before and after exposure in the CMA. The difference between the 'after' and 'before' weights is determined to be the weight of moisture absorbed by the specimen. Notwithstanding the term 'cryogenic,' the CMA is not limited to cryogenic applications: the low test temperature can be any temperature below ambient, and the specimen can be made of any material affected by moisture in air. The CMA is especially well suited for testing a variety of foam insulating materials, including those on the space-shuttle external cryogenic tanks, on other cryogenic vessels, and in refrigerators used for transporting foods, medicines, and other perishables. Testing is important because absorbed moisture not only adds weight but also, in combination with thermal cycling, can contribute to damage that degrades insulating performance. Materials are changed internally when subjected to large sub-ambient temperature gradients.
Author
Cryogenics; Ambient Temperature; Thermal Cycling Tests; Temperature Gradients; Moisture; Low Temperature; Liquid Nitrogen

20100019620 California Inst. of Tech., Pasadena, CA, USA
Reflector Surface Error Compensation in Dual-Reflector Antennas
Jamnejad, Vahraz; Imbriale, William; NASA Tech Briefs, May 2010; May 2010, pp. 30; In English; See also 20100019580
Report No.(s): NPO-45373; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019620; http://www.techbriefs.com/component/content/article/7962

By probing the field on a small subreflector at a minimal number of points, the main reflector surface errors can be obtained and subsequently used to design a phase-correction subreflector that can compensate for main reflector errors. The compensating phase-error profile across the subreflector can be achieved either by a surface deformation or by the use of an array of elements such as patch antennas that can cause a phase shift between the incoming and outgoing fields. The second option is of primary interest here, but the methodology can be applied to either case. The patch array is most easily implemented on a planar surface. Therefore, the example of a flat subreflector and a parabolic main reflector (a Newtonian dual reflector system) is considered in this work. The subreflector is assumed to be a reflector array covered with patch elements. The phase variation on a subreflector can be detected by a small number of receiving patch elements (probes). By probing the phase change at these few selected positions on the subreflector, the phase error over the entire surface can be recovered and used to change the phase of all the patch elements covering the subreflector plane to compensate for main reflector errors. This is accomplished by using a version of sampling theorem on the circular aperture. The sampling is performed on the phase-error function on the circular aperture of the main reflector by a method developed using Zernike polynomials. This method is based upon and extended from a theory previously proposed and applied to reflector aperture integration. This sampling method provides for an exact retrieval of the coefficients of up to certain orders in the expansion of the phase function, from values on a specifically calculated set of points in radial and azimuthal directions in the polar coordinate system, on the circular reflector aperture. The corresponding points on the subreflector are then obtained and, by probing the fields at these points, a set of phase values is determined that is then transferred back to the main reflector aperture

for recovering the phase function. Once this function is recovered, the corresponding phase function on the subreflector is calculated and used to compensate for main reflector surface errors. In going back and forth between sub and main reflectors, geometrical (ray) optics is employed, which even though it ignores edge diffraction and other effects, is shown to be accurate for phase recovery.
Author
Reflector Antennas; Parabolic Reflectors; Phase Shift; Phase Error; Error Functions; Coordinates; Diffraction; Polar Coordinates

20100019621 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Finned Carbon-Carbon Heat Pipe with Potassium Working Fluid
Juhasz, Albert J.; NASA Tech Briefs, May 2010; May 2010, pp. 26-27; In English; See also 20100019580; Original contains color illustrations
Report No.(s): LEW-18307-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019621; http://www.techbriefs.com/component/content/article/7958

This elemental space radiator heat pipe is designed to operate in the 700 to 875 K temperature range. It consists of a C-C (carbon-carbon) shell made from poly-acrylonitride fibers that are woven in an angle interlock pattern and densified with pitch at high process temperature with integrally woven fins. The fins are 2.5 cm long and 1 mm thick, and provide an extended radiating surface at the colder condenser section of the heat pipe. The weave pattern features a continuous fiber bath from the inner tube surface to the outside edges of the fins to maximize the thermal conductance, and to thus minimize the temperature drop at the condenser end. The heat pipe and radiator element together are less than one-third the mass of conventional heat pipes of the same heat rejection surface area. To prevent the molten potassium working fluid from eroding the C C heat pipe wall, the shell is lined with a thin-walled, metallic tube liner (Nb-1 wt.% Zr), which is an integral part of a hermetic metal subassembly which is furnace-brazed to the inner surface of the C-C tube. The hermetic metal liner subassembly includes end caps and fill tubes fabricated from the same Nb-1Zr alloy. A combination of laser and electron beam methods is used to weld the end caps and fill tubes. A tungsten/inert gas weld seals the fill tubes after cleaning and charging the heat pipes with potassium. The external section of this liner, which was formed by a 'Uniscan' rolling process, transitions to a larger wall thickness. This section, which protrudes beyond the C-C shell, constitutes the 'evaporator' part of the heat pipe, while the section inside the shell constitutes the condenser of the heat pipe (see figure).
Author
Heat Pipes; Potassium; Working Fluids; Subassemblies; Thermal Conductivity; High Temperature; Laser Beams; Carbon; Hermetic Seals

20100019622 Thermacore, Inc., Lancaster, PA, USA
Lightweight Heat Pipes Made from Magnesium
Rosenfeld, John N.; Zarembo, Sergei N.; Eastman, G. Yale; NASA Tech Briefs, May 2010; May 2010, pp. 27; In English; See also 20100019580
Report No.(s): MSC-23397-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019622; http://www.techbriefs.com/component/content/article/7957

Magnesium has shown promise as a lighter-weight alternative to the aluminum alloys now used to make the main structural components of axially grooved heat pipes that contain ammonia as the working fluid. Magnesium heat-pipe structures can be fabricated by conventional processes that include extrusion, machining, welding, and bending. The thermal performances of magnesium heat pipes are the same as those of equal-sized aluminum heat pipes. However, by virtue of the lower mass density of magnesium, the magnesium heat pipes weigh 35 percent less. Conceived for use aboard spacecraft, magnesium heat pipes could also be attractive as heat-transfer devices in terrestrial applications in which minimization of weight is sought: examples include radio-communication equipment and laptop computers.
Author
Magnesium; Heat Pipes; Structural Design; Working Fluids; Aluminum Alloys; Heat Transfer

20100019623 NASA Glenn Research Center, Cleveland, OH, USA
Offset Compound Gear Drive
Stevens, Mark A.; Handschuh, Robert F.; Lewicki, David G.; NASA Tech Briefs, May 2010; May 2010, pp. 23-24; In English; See also 20100019580
Report No.(s): LEW-18340-1; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019623; http://www.techbriefs.com/component/content/article/7953

The Offset Compound Gear Drive is an in-line, discrete, two-speed device utilizing a special offset compound gear that

has both an internal tooth configuration on the input end and external tooth configuration on the output end, thus allowing it to mesh in series, simultaneously, with both a smaller external tooth input gear and a larger internal tooth output gear. This unique geometry and offset axis permits the compound gear to mesh with the smaller diameter input gear and the larger diameter output gear, both of which are on the same central, or primary, centerline. This configuration results in a compact in-line reduction gear set consisting of fewer gears and bearings than a conventional planetary gear train. Switching between the two output ratios is accomplished through a main control clutch and sprag. Power flow to the above is transmitted through concentric power paths. Low-speed operation is accomplished in two meshes. For the purpose of illustrating the low-speed output operation, the following example pitch diameters are given. A 5.0 pitch diameter (PD) input gear to 7.50 PD (internal tooth) intermediate gear (0.667 reduction mesh), and a 7.50 PD (external tooth) intermediate gear to a 10.00 PD output gear (0.750 reduction mesh). Note that it is not required that the intermediate gears on the offset axis be of the same diameter. For this example, the resultant low-speed ratio is 2:1 (output speed = 0.500; product of stage one 0.667 reduction and stage two 0.750 stage reduction). The design is not restricted to the example pitch diameters, or output ratio. From the output gear, power is transmitted through a hollow drive shaft, which, in turn, drives a sprag during which time the main clutch is disengaged. Author

Low Speed; Shafts (Machine Elements); Clutches; Gears; Mechanical Drives

20100019624 California Inst. of Tech., Pasadena, CA, USA

Graph-Based Path-Planning for Titan Balloons

Blackmore, Lars James; Fathpour, Nanaz; Elfes, Alberto; NASA Tech Briefs, May 2010; May 2010, pp. 39; In English; See also 20100019580

Report No.(s): NPO-46607; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019624; http://www.techbriefs.com/component/content/article/7967

A document describes a graph-based path-planning algorithm for balloons with vertical control authority and little or no horizontal control authority. The balloons are designed to explore celestial bodies with atmospheres, such as Titan, a moon of Saturn. The algorithm discussed enables the balloon to achieve horizontal motion using the local horizontal winds. The approach is novel because it enables the balloons to use arbitrary wind field models. This is in contrast to prior approaches that used highly simplified wind field models, such as linear, or binary, winds. This new approach works by discretizing the space in which the balloon operates, and representing the possible states of the balloon as a graph whose arcs represent the time taken to move from one node to another. The approach works with arbitrary wind fields, by looking up the wind strength and direction at every node in the graph from an arbitrary wind model. Having generated the graph, search techniques such as Dijkstra s algorithm are then used to find the set of vertical actuation commands that takes the balloon from the start to the goal in minimum time. In addition, the set of reachable locations on the moon or planet can be determined.
Author

Titan; Balloons; Wind Direction; Velocity Distribution; Trajectory Planning; Wind Velocity

20100019625 California Inst. of Tech., Pasadena, CA, USA

Air-Sea Spray Airborne Radar Profiler Characterizes Energy Fluxes in Hurricanes

Durden, Stephen L.; Esteban-Fermandez, D.; NASA Tech Briefs, May 2010; May 2010, pp. 39; In English; See also 20100019580

Report No.(s): NPO-46537; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019625; http://www.techbriefs.com/component/content/article/7970

A report discusses ASAP (Air-sea Spray Airborne Profiler), a dual-wavelength radar profiler that provides measurement information about the droplet size distribution (DSD) of sea-spray, which can be used to estimate heat and moisture fluxes for hurricane research. Researchers have recently determined that sea spray can have a large effect on the magnitude and distribution of the air-sea energy flux at hurricane -force wind speeds. To obtain information about the DSD, two parameters of the DSD are required; for example, overall DSD amplitude and DSD mean diameter. This requires two measurements. Two frequencies are used, with a large enough separation that the differential frequency provides size information. One frequency is 94 GHz; the other is 220 GHz. These correspond to the Rayleigh and Mie regions. Above a surface wind speed of 10 m/s, production of sea spray grows exponentially. Both the number of large droplets and the altitude they reach are a function of the surface wind speed.
Author

Airborne Radar; Flux Density; Heat Flux; Hurricanes; Wind Velocity; Drop Size; Ground Wind

20100019626 California Inst. of Tech., Pasadena, CA, USA

Using Whispering-Gallery-Mode Resonators for Refractometry

Matsko, Andrey; Savchenkov, Anatoliy; Strekalov, Dmitry; Iltchenko, Vladimir; Maleki, Lute; NASA Tech Briefs, May 2010; May 2010, pp. 33-34; In English; See also 20100019580; Original contains black and white illustrations

Report No.(s): NPO-42694; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019626; http://www.techbriefs.com/component/content/article/7917

A method of determining the refractive and absorptive properties of optically transparent materials involves a combination of theoretical and experimental analysis of electromagnetic responses of whispering-gallery-mode (WGM) resonator disks made of those materials. The method was conceived especially for use in studying transparent photorefractive materials, for which purpose this method affords unprecedented levels of sensitivity and accuracy. The method is expected to be particularly useful for measuring temporally varying refractive and absorptive properties of photorefractive materials at infrared wavelengths. Still more particularly, the method is expected to be useful for measuring drifts in these properties that are so slow that, heretofore, the properties were assumed to be constant. The basic idea of the method is to attempt to infer values of the photorefractive properties of a material by seeking to match (1) theoretical predictions of the spectral responses (or selected features thereof) of a WGM of known dimensions made of the material with (2) the actual spectral responses (or selected features thereof). Spectral features that are useful for this purpose include resonance frequencies, free spectral ranges (differences between resonance frequencies of adjacently numbered modes), and resonance quality factors (Q values). The method has been demonstrated in several experiments, one of which was performed on a WGM resonator made from a disk of LiNbO3 doped with 5 percent of MgO. The free spectral range of the resonator was approximately equal to 3.42 GHz at wavelengths in the vicinity of 780 nm, the smallest full width at half maximum of a mode was approximately equal to 50 MHz, and the thickness of the resonator in the area of mode localization was 30 microns. In the experiment, laser power of 9 mW was coupled into the resonator with an efficiency of 75 percent, and the laser was scanned over a frequency band 9 GHz wide at a nominal wavelength of approximately equal to 780 nm. Resonance frequencies were measured as functions of time during several hours of exposure to the laser light. The results of these measurements, plotted in the figure, show a pronounced collective frequency drift of the resonator modes. The size of the drift has been estimated to correspond to a change of 8.5 x 10(exp -5) in the effective ordinary index of refraction of the resonator material.

Derived from text

Doped Crystals; Resonators; Whispering Gallery Modes; Transparence; Photorefractivity

20100019627 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Three Methods of Detection of Hydrazines

Griffin, Timothy; Berger, Cristina; NASA Tech Briefs, May 2010; May 2010, pp. 7-8; In English; See also 20100019580; Original contains color illustrations

Report No.(s): KSC-13121/2/3; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019627; http://www.techbriefs.com/component/content/article/7930

Three proposed methods for measuring trace quantities of hydrazines involve ionization and detection of hydrazine derivatives. These methods are intended to overcome the limitations of prior hydrazine- detection methods. Hydrazine (Hz), monomethylhydrazine (MMH), and unsymmetrical dimethylhydrazine (UDMH) are hypergolic fuels and are highly reactive, toxic, and corrosive. A capability to measure concentrations of hydrazines is desirable for detecting leaks and ensuring safety in aerospace settings and in some industrial settings in which these compounds are used. One of the properties (high reactivity) that make it desirable to detect trace amounts of hydrazines also makes it difficult to detect hydrazines and measure their concentrations accurately using prior methods: significant amounts are lost to thermal and catalytic decomposition prior to detection. Further complications arise from the sticky nature of hydrazines: Sample hydrazine molecules tend to become irreversibly adsorbed onto solid surfaces with which they come into contact during transport to detectors, giving rise to drift in detector responses. In each proposed method, the reactive, sticky nature of hydrazines would be turned to advantage by providing a suitably doped substrate surface with which the hydrazines would react. The resulting hydrazine derivatives would be sufficiently less sticky and sufficiently more stable so that fewer molecules would be lost to decomposition or adsorption during transport. Consequently, it would be possible to measure concentration with more sensitivity and less error than in prior techniques. The first proposed method calls for the use of a recently developed technique known as desorption electrospray ionization (DESI), in which a pneumatically assisted micro -electrospray at ambient pressure is directed at a surface of interest. In this case, the surface of interest would be that of a substrate described above.

Derived from text

Detection; Ionization; Desorption; Monomethylhydrazines; Dimethylhydrazines

20100019636 University of South Florida, Tampa, FL USA

Managing Workload in Human-Robot Interaction: A Review of Empirical Studies

Prewett, Matthew S; Johnson, Ryan C; Saboe, Kristin N; Elliott, Linda R; Coovert, Michael D; Jan 2010; 18 pp.; In English

Contract(s)/Grant(s): DAAD19-01-C-0065

Report No.(s): AD-A518807; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518807

Working with artificial agents is a challenging endeavor, often imposing high levels of workload on human operators who work within these socio-technical systems. We seek to understand these workload demands through examining the literature in major content areas of human-robot interaction. As research on HRI continues to explore a host of issues with operator workload, there is a need to synthesize the extant literature to determine its current state and to guide future research. Within HRI sociotechnical systems, we reviewed the empirical literature on operator information processing and action execution. Using multiple resource theory as a guiding framework, we organized this review by the operator perceptual and responding demands which are routinely manipulated in HRI studies. We also reviewed the utility of different interventions for reducing the strain on the perceptual system (e.g., multimodal displays) and responses (e.g., automation). Our synthesis of the literature demonstrates that much is known about how to decrease operator workload, but there are specific gaps in knowledge due to study operations and methodology. This work furthers our understanding of workload in complex environments such as those found when working with robots. Principles and propositions are provided for those interested in decreasing operator workload in applied settings and also for future research.

DTIC

Man Machine Systems; Robots; Surveys; Teleoperators; Workloads (Psychophysiology)

20100019640 California Univ., Berkeley, CA USA

DexterNet: An Open Platform for Heterogeneous Body Sensor Networks and Its Applications

Kuryloski, Philip; Giani, Annarita; Giannantonio, Roberta; Gilani, Katherine; Gravina, Raffaele; Seppa, Ville-Pekka; Seto, Edmund; Shia, Victor; Wang, Curtis; Yan, Posu; Dec 19, 2008; 14 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0244

Report No.(s): AD-A518835; UCB/EECS-2008-174; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518835

In this paper, we present an open-source platform for wireless body sensor networks called DexterNet. The system is motivated by shifting research paradigms to support real-time, persistent human monitoring in both indoor and outdoor environments. The platform utilizes a three-layer architecture to control heterogeneous body sensors. The first layer, called the body sensor layer (BSL), deals with design of different wireless body sensors and their instrumentation on the body. We detail two custom-built body sensors: one measuring body motions and the other measuring the ECG and respiratory patterns. At the second layer, called the personal network layer (PNL), the wireless body sensors on a single subject communicate with a mobile base station, which supports Linux OS and the IEEE 802.15.4 protocol. The BSL and PNL functions are abstracted and implemented as an open-source software library, called Signal Processing In Node Environment (SPINE). A DexterNet network is scalable, and can be reconfigured on-the-fly via SPINE. At the third layer, called the global network layer (GNL), multiple PNLs communicate with a remote Internet server to permanently log the sensor data and support higher-level applications. We demonstrate the versatility of the DexterNet platform via three applications: avatar visualization, human activity recognition, and integration of DexterNet with global positioning sensors and air pollution sensors for asthma studies.

DTIC

Bioinstrumentation; Communication Networks; Heterogeneity; Human Body

20100019644 Air Force Research Lab., Wright-Patterson AFB, OH USA

Mixed- & Homogeneous-Culture Military Team Performance on a Simulated Mission: Effects of Age, Computer-Game Experience

Warren, Rik; Feb 2008; 30 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A518848; AFRL-RH-WP-TP-2010-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518848

In order to investigate the performance of mixed- versus homogeneous-culture four-person military teams, the NATO Human Factors and Medicine Panel (HFM-138) on Adaptability in Multinational Coalitions conducted a computer-based experiment. This paper examines the role of age, computer-game experience, and English proficiency as confounding variables

in explaining the results. A key finding is that differences among national groups disappear when the effects of the confounds are removed, but the mixed-culture teams now have the best performance. Some reasons for these findings and the implications for military selection, training, and procedures are discussed.
DTIC
Age Factor; English Language; Human Factors Engineering; Human Performance; Teams

20100019874 Government of Canada, Ottawa, Ontario Canada
Survival in Cold Waters: Staying Alive
Brooks, C J; Jan 2003; 93 pp.; In English
Contract(s)/Grant(s): T8275-010075/001/SS
Report No.(s): AD-A519342; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is quite astonishing that over the centuries, hundreds and thousands of humans have drowned in cold water, and it is only in the last 50 years that anyone has taken this death toll seriously. Death was attributed to drowning from an inability to stay afloat and vague terms, such as exposure. This is because death at sea was, and to some degree still is considered an occupational hazard. Fishermen for instance, who are most at risk, simply considered it as on occupational hazard and fate. Any attempt at protection was to float the person in rather than out of the water. 2. It took until the middle of the Second World War for the UK and Germany, and post-Korean war for the US to realize that there was a problem from sudden cold water immersion. 3. As a result, internationally over the last half of the 20th century, there has been considerable human experimentation in cold water physiology. The pioneering work was done in the mid- 1940s and 1950s, but by the 1960s, it appears to have been forgotten and needed to be relearned. The advent of the offshore oil industry created a demand for more research to produce better immersion suits. This created a flurry of experimentation in the 1980s and 1990s. A number of these experiments have been cited to give the reader the wide scope of them.
DTIC
Cold Water; Hazards; Hypothermia; Survival

20100019877 Army Soldier Systems Command, Natick, MA USA
A Commercial IOTV Cleaning Study
Yung, Kailim W; Sellazzo, Jason; Fanning, Norm; Apr 12, 2010; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519348; ILSC-SPSID-10-TR-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A commercial cleaning trial was conducted to evaluate the viability of Traditional Wet Laundering, Computer-controlled Wet Cleaning, Liquid CO2 Cleaning and Solvair(Registered trademark) Cleaning in cleaning soiled Improved Outer Tactical Vests (IOTV). Computer-controlled Wet Cleaning coupled with the use of LANADOL(Registered trademark) AVANT and AKTIV detergents was found to be most effective while preserving the key functionalities of the vest. This report outlines the methodology, results and conclusions of the study. It also provides the Business Case Analyses (BCA) on the economics of these four commercial cleaning technologies and on the financial benefits of Computer-controlled Wet Cleaning versus the current practice of Discard and Replace. As a result of the study, a Maintenance Action Message (MAM) was published on October 26, 2009 authorizing the use of Computer-controlled Wet Cleaning as an interim solution to clean soiled IOTVs.
DTIC
Armor; Cleaning; Commerce; Computer Programs

20100020168 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Control of Technology Transfer at JPL
Oliver, Ronald; April 25, 2006; 49 pp.; In English; Export Technology Controls, 25 Apr. 2006, San Jose, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41547

Controlled Technology: 1) Design: preliminary or critical design data, schematics, technical flow charts, SNV code/diagnostics, logic flow diagrams, wirelist, ICDs, detailed specifications or requirements. 2) Development: constraints, computations, configurations, technical analyses, acceptance criteria, anomaly resolution, detailed test plans, detailed technical proposals. 3) Production: process or how-to: assemble, operated, repair, maintain, modify. 4) Manufacturing: technical instructions, specific parts, specific materials, specific qualities, specific processes, specific flow. 5) Operations: how-to operate, contingency or standard operating plans, Ops handbooks. 6) Repair: repair instructions, troubleshooting schemes, detailed schematics. 7) Test: specific procedures, data, analysis, detailed test plan and retest plans, detailed anomaly resolutions, detailed failure causes and corrective actions, troubleshooting, trended test data, flight readiness data. 8)

Maintenance: maintenance schedules and plans, methods for regular upkeep, overhaul instructions. 9) Modification: modification instructions, upgrades kit parts, including software
Author
Technology Transfer; Information Flow; Diagnosis; Handbooks; Maintenance; Quality; Anomalies; Flow Charts

20100020239 Pennsylvania Univ., Philadelphia, PA USA
PreSTA: Preventing Malicious Behavior Using Spatio-Temporal Reputation
West, Andrew G; Nov 4, 2009; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519207; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519207

FUTURE: WIKIPEDIA -- PURPOSE: Build a blacklist of user-names/IPs based on the probability they will vandalize. TEMPORAL: Straightforward, vandals are probably repeat offenders * Registered users have IDs indicating when they joined, are new users more likely to vandalize? SPATIAL: Geographical -- Based on user location (i.e., Washington, DC) * Topical: A user may vandalize one topic (Rush Limbaugh) while properly editing another (Barack Obama) * Anonymous users: IP address properties * Certain administrators have rollback (revert) privileges * Comment: Reverted edit by X to last edition by Y.
DTIC
Prevention; Probability Theory; Protocol (Computers)

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20100018387 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mars Technology Program: Planetary Protection Technology Development
Lin, Ying; March 6, 2006; 16 pp.; In English; IEEE Aerospace Conference, 5 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41557

This slide presentation reviews the development of Planetary Protection Technology in the Mars Technology Program. The goal of the program is to develop technologies that will enable NASA to build, launch, and operate a mission that has subsystems with different Planetary Protection (PP) classifications, specifically for operating a Category IVb-equivalent subsystem from a Category IVa platform. The IVa category of planetary protection requires bioburden reduction (i.e., no sterilization is required) The IVb category in addition to IVa requirements: (i.e., terminal sterilization of spacecraft is required). The differences between the categories are further reviewed.
CASI
Planetary Protection; Spacecraft Sterilization; Decontamination

20100019578 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Amino Acids from Icy Amines: A Radiation-Chemical Approach to Extraterrestrial Synthesis
Dworkin, J. P.; Moore, M. H.; April 25, 2010; 1 pp.; In English; Astrobiology Science Conference 2010. Evolution and Life: Surviving Catastrophese and Extremes on Earth and Beyond, 25-28 Apr. 2010, Houston, TX, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019578

Detections of amino acids in meteorites go back several decades, with at least 100 such compounds being reported for the Murchison meteorite alone. The presence of these extraterrestrial molecules raises questions as to their formation, abundance, thermal stability, racemization, and possible subsequent reactions. Although all of these topics have been studied in laboratories, such work often involves many variables and unknowns. This has led us to seek out model systems with which to uncover reaction products, test chemical predictions, and sited light on underlying reaction mechanisms. This presentation will describe one such study, focusing on amino-acid formation in ices.
Derived from text
Amino Acids; Ice; Reaction Kinetics; Synthesis (Chemistry); Amines; Extraterrestrial Matter

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20100018381 North Carolina State Univ., Raleigh, NC, USA
Benchmarking for North Carolina Public Transportation Systems
Cook, Thomas J.; Lawrie, Judson J.; June 30, 2006; 198 pp.; In English
Report No.(s): PB2010-105924; No Copyright; Avail.: CASI: A09, Hardcopy

The North Carolina Department of Transportation, Public Transportation Division (NCDOT/PTD) requested recommendations for a benchmarking process for public transportation systems. This request was driven by the need to ensure that transit systems meet the needs of their communities, that they do so efficiently and effectively, and that they offer a variety and quality of services that meet the public demand. In addition, the request reflects NCDOTs overall desire to provide good stewardship of local, state and federal public funding dollars. Performance measurement is a precursor to benchmarking, and involves objective measurements of an organizations activities for comparison and improvement. Performance measures are of most value when they can be compared to something else. Benchmarking is a process of identifying standards against which appropriate comparisons can be made. This research study built upon the findings from the recent NCDOT research study performed by ITRE, Use of Performance Standards and Measures for Public Transportation Systems (1). That study looked at the development of performance measures for North Carolina transit systems and their possible use in allocating transit funding. This study built upon those performance measures in order to incorporate effective standards or benchmarks. The project was aimed at providing three primary products: (1) A set of selected benchmarks for public transit systems, particularly efficiency and effectiveness benchmarks that are commonly used by other transit systems and funding agencies, and including benchmarks that specifically relate to important customer satisfaction factors identified as part of the study. (2) A recommended benchmarking process and Guidebook that can be used by public transit systems in North Carolina to measure their performance and to then institute steps to improve any areas of low performance. (3) A set of minimum statewide standards that would be used by NCDOT/PTD to provide incentives and disincentives that would encourage public transit systems to steadily improve performance. In addition, an Internet listserv was created that will provide an effective communications method for sharing and disseminating information on, and questions about, benchmarking activities and best practices.
NTIS
Transportation; Communication; Information Dissemination

20100018414 NASA Johnson Space Center, Houston, TX, USA
JSC Wireless Sensor Network Update
Wagner, Robert; May 03, 2010; 24 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-20489; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018414

Sensor nodes composed of three basic components... radio module: COTS radio module implementing standardized WSN protocol; treated as WSN modem by main board main board: contains application processor (TI MSP430 microcontroller), memory, power supply; responsible for sensor data acquisition, pre-processing, and task scheduling; re-used in every application with growing library of embedded C code sensor card: contains application-specific sensors, data conditioning hardware, and any advanced hardware not built into main board (DSPs, faster A/D, etc.); requires (re-) development for each application.
Author
Protocol (Computers); Data Acquisition; Memory (Computers); Scheduling; Data Processing

20100018456 Government Accountability Office, Washington, DC, USA
Telecommunications: Information Collection and Management at the Federal Communications Commission
January 2010; 35 pp.; In English
Report No.(s): PB2010-105931; GAO-10-249; No Copyright; Avail.: CASI: A03, Hardcopy

The Federal Communications Commission (FCC) regulates industries that affect the lives of virtually all Americans. FCC-regulated industries provide Americans with daily access to communications services, including wireline and wireless telephone, radio, and television. To ensure FCC is carrying out its mission, the commission requires a significant amount of information, such as ownership and operating information from radio and television stations. In prior reports, GAO has found

weaknesses with FCC's information collection, management, and reporting processes. While FCC has taken action, the commission has not implemented all the recommendations associated with information collection, management, and reporting. As requested, this report provides information on (1) the information FCC collects; (2) how FCC collects and manages information; (3) the strengths and weaknesses, if any, in FCC's information collection and management practices; and (4) the status of FCC's internal review of its information collection and management practices. To complete this work, GAO gathered information on FCC's information collection efforts, reviewed information collection and management practices for 30 collection instruments, interviewed agency officials and industry stakeholders, and reviewed relevant laws and guidance. FCC provided comments which discuss its efforts to improve data management.
NTIS
Information Management; Telephones; Laws; Television Systems; Data Management

20100018457
Cybersecurity: Progress Made but Challenges Remain in Defining and Coordinating the Comprehensive National Initiative
March 2010; 64 pp.; In English
Report No.(s): PB2010-105933; GAO-10-338; No Copyright; Avail.: CASI: A04, Hardcopy

In response to the ongoing threats to federal systems and operations posed by cyber attacks, President Bush established the Comprehensive National Cybersecurity Initiative (CNCI) in 2008. This initiative consists of a set of projects aimed at reducing vulnerabilities, protecting against intrusions, and anticipating future threats. GAO was asked to determine (1) what actions have been taken to develop interagency mechanisms to plan and coordinate CNCI activities and (2) what challenges CNCI faces in achieving its objectives related to securing federal information systems. To do this, GAO reviewed CNCI plans, policies, and other documentation and interviewed officials at the Office of Management and Budget (OMB), Department of Homeland Security, and the Office of the Director of National Intelligence (ODNI), among other agencies. GAO also reviewed studies examining aspects of federal cybersecurity and interviewed recognized cybersecurity experts.
NTIS
Information Systems; Intrusion; Security; Intelligence

20100018459
Secure Border Initiative: DHS Needs to Address Testing and Performance Limitations That Place Key Technology Program at Risk
January 2010; 47 pp.; In English
Report No.(s): PB2010-105939; GAO-10-158; No Copyright; Avail.: CASI: A03, Hardcopy

The Department of Homeland Security's (DHS) Secure Border Initiative Network (SBInet) is a multiyear, multibillion dollar program to deliver surveillance and decision-support technologies that create a virtual fence and situational awareness along the nation's borders with Mexico and Canada. Managed by DHS's Customs and Border Protection (CBP), SBInet is to strengthen CBP's ability to identify, deter, and respond to illegal breaches at and between border points of entry. Because of the program's importance, cost, and risks, GAO was asked to, among other things, determine (1) whether SBInet testing has been effectively managed, including the types of tests performed and whether they were well planned and executed, and (2) what the results of testing show. To do this, GAO reviewed test management documentation, including test plans, test cases, test procedures, and results relative to federal and related guidance, and interviewed program and contractor officials.
NTIS
Canada; Risk; Security

20100018482 Texas A&M Univ., College Station, TX USA
Improved Intersection Operations During Detector Failures
Sunkari, Srinivasa; Songchitruksa, Praprut; Charara, Hassan; Zeng, Xiaosi; March 2010; 86 pp.; In English
Report No.(s): PB2010-105960; REPT-0-6029-1; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this project was to develop three modules that would improve the efficiency of intersection operations at isolated signalized intersections. The motivation for these modules was to use the existing detectors more efficiently. This would in turn reduce the number of detectors required at the intersection and also improve operations in case of detector failures. The adaptive variable initial module (Module 1) can improve the typical variable initial feature available in most signal controllers by factoring the turning movements at the intersections in real time along with queue distribution, and activity on driveways between the detectors and stop bar. The detector failure module (Module 2) develops a rolling database

of phase utilizations of all phases at the intersections. The module uses this database to determine the appropriate phase time when a detector failure is identified. The variable detector module (Module 3) monitors the phase utilizations on the major-street phase and the volume on the right-turn and left-turn detectors to vary the delay programmed on detectors to further improve the intersection operations. Researchers evaluated Module 1 and Module 2 and found them improving the intersection operations. However, initial implementations of Module 3 showed limited benefits and only under very rare conditions. Thus, researchers did not develop Module 3 further. Modules 1 and 2 require data that are easily available within the controller and can be incorporated into the signal controller firmware.
NTIS
Failure; Controllers; Intersections; Firmware; Modules; Real Time Operation; Streets

20100018485 Royal Inst. of Tech., Stockholm, Sweden
Approximative Linear and Logarithmic Interpolation of Spectra
Enqvist, Per; Avventi, Enrico; January 2009; 28 pp.; In English
Report No.(s): PB2010-106026; TRITA-MAT-09-OS-02; Copyright; Avail.: National Technical Information Service (NTIS)
Given output data of a stationary stochastic process estimates of covariance and cepstrum parameters can be obtained. These estimates can be used to determine ARMA models to approximately fit the data by matching the parameters exactly. However, the estimates of the parameters may contein large errors, especially if they are determined from short data sequences, and thus it makes sense to match the parameters only in an approximate way. Here we consider a convex method for solving an approximative linear and logarithmic spectrum interpolation problem while maximizing the entropy and penalize the quadratic deviation from the nominal parameters.
NTIS
Interpolation; Linear Systems

20100018517 Newcastle-upon-Tyne Univ., Newcastle, UK
What Can the Pi-Calculus Tell Us About the Mondex Purse System
Jones, Cliff B.; Pierce, Ken G.; January 2010; 11 pp.; In English
Report No.(s): PB2010-106108; CS-TR-1185; Copyright; Avail.: National Technical Information Service (NTIS)
This paper looks at the wider system surrounding a 'Mondex' electronic purse. It does this from a process-oriented perspective using the pi-calculus. Our model includes the issuing of purses by an authorised bank and the decisions of cardholders to participate in transactions.
NTIS
Calculus; Electronic Equipment

20100018518 Newcastle-upon-Tyne Univ., Newcastle, UK
Splitting Atoms with Rely/Guarantee Conditions Coupled with Data
Jones, Cliff B.; Pierce, Ken G.; March 2010; 24 pp.; In English
Report No.(s): PB2010-106106; CS-TR-1186; Copyright; Avail.: National Technical Information Service (NTIS)
This paper presents a novel formal development of a non-trivial parallel program: Simpson's implementation of asynchronous communication mechanisms (ACMs). Although the correctness of the '4-slot algorithm' has been shown elsewhere, earlier developments are by no means intuitive. The aims of this paper include both the presentation of an understandable (yet formal) design history and the establishment of another way of 'splitting (software) atoms.' Using the 'fiction of atomicity' as an aid to understanding the initial steps of development, the top-level specification is developed to code. The rely-guarantee approach is, here, combined with notions of read/write frames and 'phased' specifications; the atomicity assumptions implied by rely/guarantee conditions are realised by clever choice of data representation. The development method herein is compared with other approaches--in a spirit of cooperation--as the authors believe that constructive comparison elucidates many of the finer point in the '4-slot' specification/development and of parallel programs in general.
NTIS
Parallel Programming; Computer Programs

20100018524 Newcastle-upon-Tyne Univ., Newcastle, UK
Architecture and Protocol for User-Controlled Access Management in Web 2.0 Applications
Machulak, Maciej; van Moorsel, Aad; March 2010; 16 pp.; In English
Report No.(s): PB2010-106105; CS-TR-1191; Copyright; Avail.: National Technical Information Service (NTIS)
The rapidly developing Web environment provides users with a wide set of rich services as varied and complex as desktop

applications. Those services are collectively referred to as 'Web 2.0,' with examples such as Google Docs, Flickr, or Wordpress, that allow users to create, manage, and share their content online. By switching from desktop applications to their cloud-based Web equivalents more and more data is released online. It is the user who creates data, who desseminates it and who shares it with other users and services. Storing and sharing resources on the Web poses new security challenges. Access control, in particular, is current poorly addressed in such an environment and is not well suited to the increasing amount of resources that are available online. We propose a new approach to access control for the Web. Our approach puts a user in full control of access to their resources which may be scattered across multiple closed-based Web applications. Unlike existing authorization systems, it relies on a user's centrally located security requirements for these resources.
NTIS
Access Control; Computer Networks; Protocol (Computers); World Wide Web

20100018527 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Computing Controllable Sets of Hybrid Systems
Collins, Pieter J.; October 2008; 16 pp.; In English
Contract(s)/Grant(s): NWO Vidi Grant 639.032.408
Report No.(s): PB2010-107588; MAS-R0807; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we consider the controllability problem for hybrid systems, namely that of determining the set of states which can be driven into a given target set. We show that given a suitable definition of controllability, we can effectively compute arbitrarily accurate under-approximations to the controllable set using Turing machines. However, due to grazing or sliding along guard sets, we see that it may be able to demonstrate that an initial state can be controlled to the target set, without knowing any trajectory which solves the problem.
NTIS
Computer Programs; Control Theory; Systems Engineering

20100018529 NASA Langley Research Center, Hampton, VA, USA
Proceedings of the Second NASA Formal Methods Symposium
Munoz, Cesar, Editor; April 2010; 246 pp.; In English; Second NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington, DC, USA; See also 20100018530 - 20100018556; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 411931.02.51.07.01
Report No.(s): NASA/CP-2010-216215; L-19844; NF1676L-10398; Copyright; Avail.: CASI: A11, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018529

This publication contains the proceedings of the Second NASA Formal Methods Symposium sponsored by the National Aeronautics and Space Administration and held in Washington D.C. April 13-15, 2010. Topics covered include: Decision Engines for Software Analysis using Satisfiability Modulo Theories Solvers; Verification and Validation of Flight-Critical Systems; Formal Methods at Intel -- An Overview; Automatic Review of Abstract State Machines by Meta Property Verification; Hardware-independent Proofs of Numerical Programs; Slice-based Formal Specification Measures -- Mapping Coupling and Cohesion Measures to Formal Z; How Formal Methods Impels Discovery: A Short History of an Air Traffic Management Project; A Machine-Checked Proof of A State-Space Construction Algorithm; Automated Assume-Guarantee Reasoning for Omega-Regular Systems and Specifications; Modeling Regular Replacement for String Constraint Solving; Using Integer Clocks to Verify the Timing-Sync Sensor Network Protocol; Can Regulatory Bodies Expect Efficient Help from Formal Methods?; Synthesis of Greedy Algorithms Using Dominance Relations; A New Method for Incremental Testing of Finite State Machines; Verification of Faulty Message Passing Systems with Continuous State Space in PVS; Phase Two Feasibility Study for Software Safety Requirements Analysis Using Model Checking; A Prototype Embedding of Bluespec System Verilog in the PVS Theorem Prover; SimCheck: An Expressive Type System for Simulink; Coverage Metrics for Requirements-Based Testing: Evaluation of Effectiveness; Software Model Checking of ARINC-653 Flight Code with MCP; Evaluation of a Guideline by Formal Modelling of Cruise Control System in Event-B; Formal Verification of Large Software Systems; Symbolic Computation of Strongly Connected Components Using Saturation; Towards the Formal Verification of a Distributed Real-Time Automotive System; Slicing AADL Specifications for Model Checking; Model Checking with Edge-valued Decision Diagrams; and Data-flow based Model Analysis.
Author
Theorems; Proving; Computer Programming; Decision Theory; Program Verification (Computers); Real Time Operation; Computer Programs; Information Flow

20100018531 Minnesota Univ., Minneapolis, MN, USA

Coverage Metrics for Requirements-Based Testing: Evaluation of Effectiveness

Staats, Matt; Whalen, Michael W.; Heindahl, Mats P. E.; Rajan, Ajitha; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 161-170; In English; See also 20100018529

Contract(s)/Grant(s): NNG05CB16C; NNA06CB21A; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018531

In black-box testing, the tester creates a set of tests to exercise a system under test without regard to the internal structure of the system. Generally, no objective metric is used to measure the adequacy of black-box tests. In recent work, we have proposed three requirements coverage metrics, allowing testers to objectively measure the adequacy of a black-box test suite with respect to a set of requirements formalized as Linear Temporal Logic (LTL) properties. In this report, we evaluate the effectiveness of these coverage metrics with respect to fault finding. Specifically, we conduct an empirical study to investigate two questions: (1) do test suites satisfying a requirements coverage metric provide better fault finding than randomly generated test suites of approximately the same size?, and (2) do test suites satisfying a more rigorous requirements coverage metric provide better fault finding than test suites satisfying a less rigorous requirements coverage metric? Our results indicate (1) only one coverage metric proposed -- Unique First Cause (UFC) coverage -- is sufficiently rigorous to ensure test suites satisfying the metric outperform randomly generated test suites of similar size and (2) that test suites satisfying more rigorous coverage metrics provide better fault finding than test suites satisfying less rigorous coverage metrics.

Author

Program Verification (Computers); Software Reliability; Software Engineering; Computer Systems Performance

20100018532 Microsoft Research, Redmond, WA, USA

Decision Engines for Software Analysis Using Satisfiability Modulo Theories Solvers

Bjorner, Nikolaj; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 1; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018532

The area of software analysis, testing and verification is now undergoing a revolution thanks to the use of automated and scalable support for logical methods. A well-recognized premise is that at the core of software analysis engines is invariably a component using logical formulas for describing states and transformations between system states. The process of using this information for discovering and checking program properties (including such important properties as safety and security) amounts to automatic theorem proving. In particular, theorem provers that directly support common software constructs offer a compelling basis. Such provers are commonly called satisfiability modulo theories (SMT) solvers. Z3 is a state-of-the-art SMT solver. It is developed at Microsoft Research. It can be used to check the satisfiability of logical formulas over one or more theories such as arithmetic, bit-vectors, lists, records and arrays. The talk describes some of the technology behind modern SMT solvers, including the solver Z3. Z3 is currently mainly targeted at solving problems that arise in software analysis and verification. It has been applied to various contexts, such as systems for dynamic symbolic simulation (Pex, SAGE, Vigilante), for program verification and extended static checking (Spec#/Boggie, VCC, HAVOC), for software model checking (Yogi, SLAM), model-based design (FORMULA), security protocol code (F7), program run-time analysis and invariant generation (VS3). We will describe how it integrates support for a variety of theories that arise naturally in the context of the applications. There are several new promising avenues and the talk will touch on some of these and the challenges related to SMT solvers. Proceedings

Author

Computer Programs; Program Verification (Computers); Software Reliability; Systems Analysis; Software Engineering

20100018533 NASA Ames Research Center, Moffett Field, CA, USA; Carnegie-Mellon Univ., Pittsburgh, PA, USA

Verification and Validation of Flight-Critical Systems

Brat, Guillaume; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 2; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018533

For the first time in many years, the NASA budget presented to congress calls for a focused effort on the verification and validation (V&V) of complex systems. This is mostly motivated by the results of the VVFCS (V&V of Flight-Critical Systems) study, which should materialize as a a concrete effort under the Aviation Safety program. This talk will present the results of the study, from requirements coming out of discussions with the FAA and the Joint Planning and Development Office

(JPDO) to technical plan addressing the issue, and its proposed current and future V&V research agenda, which will be addressed by NASA Ames, Langley, and Dryden as well as external partners through NASA Research Announcements (NRA) calls. This agenda calls for pushing V&V earlier in the life cycle and take advantage of formal methods to increase safety and reduce cost of V&V. I will present the on-going research work (especially the four main technical areas: Safety Assurance, Distributed Systems, Authority and Autonomy, and Software-Intensive Systems), possible extensions, and how VVFCS plans on grounding the research in realistic examples, including an intended V&V test-bench based on an Integrated Modular Avionics (IMA) architecture and hosted by Dryden.
Author
Complex Systems; Software Engineering; Software Reliability; Program Verification (Computers); Reliability Analysis

20100018534 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Automated Assume-Guarantee Reasoning for Omega-Regular Systems and Specifications
Chaki, Sagar; Gurfinkel, Arie; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 57-66; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018534

We develop a learning-based automated Assume-Guarantee (AG) reasoning framework for verifying omega-regular properties of concurrent systems. We study the applicability of non-circular (AGNC) and circular (AG-C) AG proof rules in the context of systems with infinite behaviors. In particular, we show that AG-NC is incomplete when assumptions are restricted to strictly infinite behaviors, while AG-C remains complete. We present a general formalization, called LAG, of the learning based automated AG paradigm. We show how existing approaches for automated AG reasoning are special instances of LAG.We develop two learning algorithms for a class of systems, called infinite regular systems, that combine finite and infinite behaviors. We show that for infinity-regular systems, both AG-NC and AG-C are sound and complete. Finally, we show how to instantiate LAG to do automated AG reasoning for infinite regular, and omega-regular, systems using both AG-NC and AG-C as proof rules
Derived from text
Machine Learning; Proving; Concurrent Processing

20100018535 INTEL Corp., Hillsboro, OR, USA
Formal Methods at Intel - An Overview
Harrison, John; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 3; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018535

Since the 1990s, Intel has invested heavily in formal methods, which are now deployed in several domains: hardware, software, firmware, protocols etc. Many different formal methods tools and techniques are in active use, including symbolic trajectory evaluation, temporal logic model checking, SMT-style combined decision procedures, and interactive higher-order logic theorem proving. I will try to give a broad overview of some of the formal methods activities taking place at Intel, and describe the challenges of extending formal verification to new areas and of effectively using multiple formal techniques in combination
Author
Program Verification (Computers); Formalism; Computer Program Integrity; Software Reliability; Computer Systems Performance; Software Engineering

20100018536 California Univ., Santa Cruz, CA, USA
SimCheck: An Expressive Type System for Simulink
Roy, Pritam; Shankar, Natarajan; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 149-160; In English; See also 20100018529; Original contains color illustrations
Contract(s)/Grant(s): NNX08AY53A; NSF CSR-EHCS(CPS)-0834810; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018536

MATLAB Simulink is a member of a class of visual languages that are used for modeling and simulating physical and cyber-physical systems. A Simulink model consists of blocks with input and output ports connected using links that carry signals. We extend the type system of Simulink with annotations and dimensions/units associated with ports and links. These

types can capture invariants on signals as well as relations between signals. We define a type-checker that checks the wellformedness of Simulink blocks with respect to these type annotations. The type checker generates proof obligations that are solved by SRI's Yices solver for satisfiability modulo theories (SMT). This translation can be used to detect type errors, demonstrate counterexamples, generate test cases, or prove the absence of type errors. Our work is an initial step toward the symbolic analysis of MATLAB Simulink models.
Author
Programming Languages; Models; Computerized Simulation; Program Verification (Computers); Systems Analysis

20100018537 NASA Langley Research Center, Hampton, VA, USA
How Formal Methods Impels Discovery: A Short History of an Air Traffic Management Project
Butler, Ricky W.; Hagen, George; Maddalon, Jeffrey M.; Munoz, Cesar A.; Narkawicz, Anthony; Dowek, Gilles; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 34-46; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018537

In this paper we describe a process of algorithmic discovery that was driven by our goal of achieving complete, mechanically verified algorithms that compute conflict prevention bands for use in en route air traffic management. The algorithms were originally defined in the PVS specification language and subsequently have been implemented in Java and C++. We do not present the proofs in this paper: instead, we describe the process of discovery and the key ideas that enabled the final formal proof of correctness
Author
Algorithms; Proving; Formalism; Parameterization

20100018538 Augsburg Univ., Germany
Data-Flow Based Model Analysis
Saad, Christian; Bauer, Bernhard; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 227-231; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018538

The concept of (meta) modeling combines an intuitive way of formalizing the structure of an application domain with a high expressiveness that makes it suitable for a wide variety of use cases and has therefore become an integral part of many areas in computer science. While the definition of modeling languages through the use of meta models, e.g. in Unified Modeling Language (UML), is a well-understood process, their validation and the extraction of behavioral information is still a challenge. In this paper we present a novel approach for dynamic model analysis along with several fields of application. Examining the propagation of information along the edges and nodes of the model graph allows to extend and simplify the definition of semantic constraints in comparison to the capabilities offered by e.g. the Object Constraint Language. Performing a flow-based analysis also enables the simulation of dynamic behavior, thus providing an 'abstract interpretation'-like analysis method for the modeling domain.
Author
Dynamic Models; Data Flow Analysis; Proving

20100018540 Manchester Univ., UK
A Prototype Embedding of Bluespec System Verilog in the PVS Theorem Prover
Richards, Dominic; Lester, David; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 139-148; In English; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018540

Bluespec SystemVerilog (BSV) is a Hardware Description Language based on the guarded action model of concurrency. It has an elegant semantics, which makes it well suited for formal reasoning. To date, a number of BSV designs have been verified with hand proofs, but little work has been conducted on the application of automated reasoning. We present a prototype shallow embedding of BSV in the PVS theorem prover. Our embedding is compatible with the PVS model checker, which can automatically prove an important class of theorems, and can also be used in conjunction with the powerful proof

strategies of PVS to verify a broader class of properties than can be achieved with model checking alone.
Author
Embedding; Hardware Description Languages; Proving

20100018541 Ecole Normale Superieure, Lyon, France
Model Checking with Edge-Valued Decision Diagrams
Roux, Pierre; Siminiceanu, Radu I.; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 222-226; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018541

We describe an algebra of Edge-Valued Decision Diagrams (EVMDDs) to encode arithmetic functions and its implementation in a model checking library. We provide efficient algorithms for manipulating EVMDDs and review the theoretical time complexity of these algorithms for all basic arithmetic and relational operators. We also demonstrate that the time complexity of the generic recursive algorithm for applying a binary operator on EVMDDs is no worse than that of Multi-Terminal Decision Diagrams. We have implemented a new symbolic model checker with the intention to represent in one formalism the best techniques available at the moment across a spectrum of existing tools. Compared to the CUDD package, our tool is several orders of magnitude faster
Author
Algebra; Algorithms; Mathematical Models; Proving; Decision Theory

20100018542 Universidade Estadual de Campinas, Brazil
A New Method for Incremental Testing of Finite State Machines
Pedrosa, Lehilton Lelis Chaves; Moura, Arnaldo Vieira; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 109-118; In English; Second NASA Formal Methods Symposium, 13-15 April 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018542

The automatic generation of test cases is an important issue for conformance testing of several critical systems. We present a new method for the derivation of test suites when the specification is modeled as a combined Finite State Machine (FSM). A combined FSM is obtained conjoining previously tested submachines with newly added states. This new concept is used to describe a fault model suitable for incremental testing of new systems, or for retesting modified implementations. For this fault model, only the newly added or modified states need to be tested, thereby considerably reducing the size of the test suites. The new method is a generalization of the well-known W-method and the G-method, but is scalable, and so it can be used to test FSMs with an arbitrarily large number of states.
Author
Turing Machines; Mathematical Logic; Proving; Program Verification (Computers)

20100018543 California Inst. of Tech., Pasadena, CA, USA
Verification of Faulty Message Passing Systems with Continuous State Space in PVS
Pilotto, Concetta; White, Jerome; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 119-128; In English; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018543

We present a library of Prototype Verification System (PVS) meta-theories that verifies a class of distributed systems in which agent communication is through message-passing. The theoretic work, outlined in, consists of iterative schemes for solving systems of linear equations, such as message-passing extensions of the Gauss and Gauss-Seidel methods. We briefly review that work and discuss the challenges in formally verifying it.
Author
Messages; Prototypes; Message Processing; Parameterization; Distributed Processing

20100018544 Stony Brook Univ., Stony Brook, NY, USA
Using Integer Clocks to Verify the Timing-Sync Sensor Network Protocol
Huang, Xiaowan; Singh, Anu; Smolka, Scott A.; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 77-86; In English; NASA Formal Methods Symposium, 13-15 April 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018544

We use the UPPAAL model checker for Timed Automata to verify the Timing-Sync time-synchronization protocol for

sensor networks (TPSN). The TPSN protocol seeks to provide network-wide synchronization of the distributed clocks in a sensor network. Clock-synchronization algorithms for sensor networks such as TPSN must be able to perform arithmetic on clock values to calculate clock drift and network propagation delays. They must be able to read the value of a local clock and assign it to another local clock. Such operations are not directly supported by the theory of Timed Automata. To overcome this formal-modeling obstacle, we augment the UPPAAL specification language with the integer clock derived type. Integer clocks, which are essentially integer variables that are periodically incremented by a global pulse generator, greatly facilitate the encoding of the operations required to synchronize clocks as in the TPSN protocol. With this integer-clock-based model of TPSN in hand, we use UPPAAL to verify that the protocol achieves network-wide time synchronization and is devoid of deadlock. We also use the UPPAAL Tracer tool to illustrate how integer clocks can be used to capture clock drift and resynchronization during protocol execution
Author
Clocks; Measuring Instruments; Networks; Time Synchronization; Synchronism

20100018545 Klagenfurt Univ., Austria
Slice-Based Formal Specification Measures -- Mapping Coupling and Cohesion Measures to Formal Z
Bollin, Andreas; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 24-33; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018545

This paper demonstrates that existing slice-based measures can reasonably be mapped to the field of state-based specification languages. By making use of Z specifications this contribution renews the idea of slice-profiles and derives coupling and cohesion measures for them. The measures are then assessed by taking a critical look at their sensitiveness in respect to modifications on the specification source. The presented study shows that slice-based coupling and cohesion measures have the potential to be used as quality indicators for specifications as they reflect the changes in the structure of a specification as accustomed from their program-related pendants.
Author
High Level Languages; Functional Design Specifications; Systems Engineering; Requirements

20100018546 National Inst. of Aerospace, Hampton, VA, USA
A Machine-Checked Proof of A State-Space Construction Algorithm
Catano, Nestor; Siminiceanu, Radu I.; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 47-56; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018546

This paper presents the correctness proof of Saturation, an algorithm for generating state spaces of concurrent systems, implemented in the SMART tool. Unlike the Breadth First Search exploration algorithm, which is easy to understand and formalise, Saturation is a complex algorithm, employing a mutually-recursive pair of procedures that compute a series of non-trivial, nested local fixed points, corresponding to a chaotic fixed point strategy. A pencil-and-paper proof of Saturation exists, but a machine checked proof had never been attempted. The key element of the proof is the characterisation theorem of saturated nodes in decision diagrams, stating that a saturated node represents a set of states encoding a local fixed-point with respect to firing all events affecting only the node s level and levels below. For our purpose, we have employed the Prototype Verification System (PVS) for formalising the Saturation algorithm, its data structures, and for conducting the proofs.
Author
Algorithms; Program Verification (Computers); State Estimation; Software Reliability; Software Engineering

20100018548 Hofstra Univ., Hempstead, NY, USA
Modeling Regular Replacement for String Constraint Solving
Fu, Xiang; Li, Chung-Chih; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 67-76; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018548

Bugs in user input sanitation of software systems often lead to vulnerabilities. Among them many are caused by improper use of regular replacement. This paper presents a precise modeling of various semantics of regular substitution, such as the

declarative, finite, greedy, and reluctant, using finite state transducers (FST). By projecting an FST to its input/output tapes, we are able to solve atomic string constraints, which can be applied to both the forward and backward image computation in model checking and symbolic execution of text processing programs. We report several interesting discoveries, e.g., certain fragments of the general problem can be handled using less expressive deterministic FST. A compact representation of FST is implemented in SUSHI, a string constraint solver. It is applied to detecting vulnerabilities in web applications
Derived from text
Program Verification (Computers); Software Engineering; Symbolic Programming; Texts; Vulnerability

20100018549 Technische Hochschule, Germany
Slicing AADL Specifications for Model Checking
Odenbrett, Maximilian; Nguyen, Viet Yen; Noll, Thomas; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 217-221; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529
Contract(s)/Grant(s): 21171/07/NL/JD; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018549

To combat the state-space explosion problem in model checking larger systems, abstraction techniques can be employed. Here, methods that operate on the system specification before constructing its state space are preferable to those that try to minimize the resulting transition system as they generally reduce peak memory requirements. We sketch a slicing algorithm for system specifications written in (a variant of) the Architecture Analysis and Design Language (AADL). Given a specification and a property to be verified, it automatically removes those parts of the specification that are irrelevant for model checking the property, thus reducing the size of the corresponding transition system. The applicability and effectiveness of our approach is demonstrated by analyzing the state-space reduction for an example, employing a translator from AADL to Promela, the input language of the SPIN model checker.
Author
Algorithms; Mathematical Models; Computerized Simulation; Program Verification (Computers); Software Reliability; Software Engineering; Reliability Analysis

20100018551 California Univ., Riverside, CA, USA
Symbolic Computation of Strongly Connected Components Using Saturation
Zhao, Yang; Ciardo, Gianfranco; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 202-211; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018551

Finding strongly connected components (SCCs) in the state-space of discrete-state models is a critical task in formal verification of LTL and fair CTL properties, but the potentially huge number of reachable states and SCCs constitutes a formidable challenge. This paper is concerned with computing the sets of states in SCCs or terminal SCCs of asynchronous systems. Because of its advantages in many applications, we employ saturation on two previously proposed approaches: the Xie-Beerel algorithm and transitive closure. First, saturation speeds up state-space exploration when computing each SCC in the Xie-Beerel algorithm. Then, our main contribution is a novel algorithm to compute the transitive closure using saturation. Experimental results indicate that our improved algorithms achieve a clear speedup over previous algorithms in some cases. With the help of the new transitive closure computation algorithm, up to 10(exp 150) SCCs can be explored within a few seconds.
Author
Algorithms; Logical Elements; Proving; Symbolic Programming; Software Engineering

20100018552 Virginia Univ., Charlottesville, VA, USA
Formal Verification of Large Software Systems
Yin, Xiang; Knight, John; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 192-201; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Original contains color illustrations
Contract(s)/Grant(s): NAG1-02103; NAG1-2290; CCR-0205447; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018552

We introduce a scalable proof structure to facilitate formal verification of large software systems. In our approach, we

mechanically synthesize an abstract specification from the software implementation, match its static operational structure to that of the original specification, and organize the proof as the conjunction of a series of lemmas about the specification structure. By setting up a different lemma for each distinct element and proving each lemma independently, we obtain the important benefit that the proof scales easily for large systems. We present details of the approach and an illustration of its application on a challenge problem from the security domain
Author
Program Verification (Computers); Software Engineering; Computer Systems Design; Software Reliability

20100018553 Saarland Univ., Saarbruecken, Germany
Towards the Formal Verification of a Distributed Real-Time Automotive System
Endres, Erik; Mueller, Christian; Shadrin, Andrey; Tverdyshev, Sergey; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 212-216; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529
Contract(s)/Grant(s): BMBF01ISC38; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018553

We present the status of a project which aims at building, formally and pervasively verifying a distributed automotive system. The target system is a gate-level model which consists of several interconnected electronic control units with independent clocks. This model is verified against the specification as seen by a system programmer. The automotive system is implemented on several FPGA boards. The pervasive verification is carried out using combination of interactive theorem proving (Isabelle/HOL) and model checking (LTL).
Author
Program Verification (Computers); Real Time Operation; Distributed Processing; Computer Systems Design; Software Reliability; Software Engineering

20100018554 Milan Univ., Italy
Automatic Review of Abstract State Machines by Meta Property Verification
Arcaini, Paolo; Gargantini, Angelo; Riccobene, Elvinia; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 4-13; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529
Contract(s)/Grant(s): PRIN 2007 D-ASAP(2007XKEHFA); Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018554

A model review is a validation technique aimed at determining if a model is of sufficient quality and allows defects to be identified early in the system development, reducing the cost of fixing them. In this paper we propose a technique to perform automatic review of Abstract State Machine (ASM) formal specifications. We first detect a family of typical vulnerabilities and defects a developer can introduce during the modeling activity using the ASMs and we express such faults as the violation of meta-properties that guarantee certain quality attributes of the specification. These meta-properties are then mapped to temporal logic formulas and model checked for their violation. As a proof of concept, we also report the result of applying this ASM review process to several specifications.
Author
Temporal Logic; Mathematical Models; Program Verification (Computers); Proving; Software Reliability

20100018555 Institut National de Recherche d'Informatique et d'Automatique, France
Hardware-Independent Proofs of Numerical Programs
Boldo, Sylvie; Nguyen, Thi Minh Tuyen; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 14-23; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018555

On recent architectures, a numerical program may give different answers depending on the execution hardware and the compilation. Our goal is to formally prove properties about numerical programs that are true for multiple architectures and compilers. We propose an approach that states the rounding error of each floating-point computation whatever the environment. This approach is implemented in the Frama-C platform for static analysis of C code. Small case studies using this approach are entirely and automatically proved
Derived from text
Program Verification (Computers); Computer Systems Performance; Floating Point Arithmetic; Software Reliability

20100019321 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Multiscale Simulations of Magnetic Island Coalescence

Dorelli, John C.; May 10, 2010; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

We describe a new interactive parallel Adaptive Mesh Refinement (AMR) framework written in the Python programming language. This new framework, PyAMR, hides the details of parallel AMR data structures and algorithms (e.g., domain decomposition, grid partition, and inter-process communication), allowing the user to focus on the development of algorithms for advancing the solution of a systems of partial differential equations on a single uniform mesh. We demonstrate the use of PyAMR by simulating the pairwise coalescence of magnetic islands using the resistive Hall MHD equations. Techniques for coupling different physics models on different levels of the AMR grid hierarchy are discussed.

Author

Magnetic Islands; Partial Differential Equations; Computational Grids; Data Structures; Grid Refinement (Mathematics); Magnetohydrodynamics

20100019473 Executive Office of the President, Washington, DC, USA

Comprehensive National Cybersecurity Initiative

January 2009; 5 pp.; In English

Report No.(s): PB2010-108686; No Copyright; Avail.: CASI: A01, Hardcopy

President Obama has identified cybersecurity as one of the most serious economic and national security challenges we face as a nation, but one that we as a government or as a country are not adequately prepared to counter. Shortly after taking office, the President therefore ordered a thorough review of federal efforts to defend the U.S. information and communications infrastructure and the development of a comprehensive approach to securing America's digital infrastructure. In May 2009, the President accepted the recommendations of the resulting Cyberspace Policy Review, including the selection of an Executive Branch Cybersecurity Coordinator who will have regular access to the President. The Executive Branch was also directed to work closely with all key players in U.S. cybersecurity, including state and local governments and the private sector, to ensure an organized and unified response to future cyber incidents; strengthen public/private partnerships to find technology solutions that ensure U.S. security and prosperity; invest in the cutting-edge research and development necessary for the innovation and discovery to meet the digital challenges of our time; and begin a campaign to promote cybersecurity awareness and digital literacy from our boardrooms to our classrooms and begin to build the digital workforce of the 21st century.

NTIS

Computer Networks; Security

20100019489 Center for Mathematics and Computer Science, Amsterdam, Netherlands

Parameter Estimation for Delay Models with Discontinuous Right-Hand Sides

Ashyraliyev, M.; January 2009; 24 pp.; In English

Report No.(s): PB2010-108104; MAS-E0908; Copyright; Avail.: National Technical Information Service (NTIS)

We study delay models with discontinuous right-hand side. Lack of smoothness in the solutions of such problems may have serious consequences for parameter estimation using gradient-based approaches. Additionally, it may cause ambiguities in the parameter determinability analysis applied on the parameter estimates. In order to overcome these difficulties, we suggest a standard regularization technique to make the model continuous. We prove the convergence of the solution of the regularized model to the solution of the original problem. As a consequence of that, parameter estimates inferred from the regularized model converge to the corresponding estimates of the original problem. We support our findings with numerical illustrations for simple test problems.

NTIS

Differential Equations; Parameter Identification

20100019522 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Radboud Univ., Nijmegen, Netherlands

Sampling, Splitting and Merging in Coinductive Stream Calculus

Niqui, M.; Rutten, J.; Jan. 2009; 26 pp.; In English

Report No.(s): PB2010-108125; SEN-E0904; Copyright; Avail.: National Technical Information Service (NTIS)

We study various operations for partitioning, projecting and merging streams of data. These operations are motivated by their use in dataflow programming and the stream processing languages. We use the framework of stream calculus and stream

circuits for defining and proving properties of such operations using behavioural differential equations and coinduction proof principles. We study the invariance of certain well patterned classes of streams, namely rational and algebraic streams, under splitting and merging. Finally we show that stream circuits extended with gates for dyadic split and merge are expressive enough to realise some non-rational algebraic streams, thereby going beyond ordinary stream circuits.
NTIS
Calculus; Sampling

20100019547 Texas Univ., El Paso, TX, USA
DAiSES: Dynamic Adaptivity in Support of Extreme Scale
Teller, P. J.; May 05, 2009; 15 pp.; In English
Contract(s)/Grant(s): FG02-04ER25622
Report No.(s): DE2010-951983; DOE/ER-25622-1; No Copyright; Avail.: Department of Energy Information Bridge

The DAiSES project (Te04) was focused on enabling conventional operating systems, in particular, those running on extreme scale systems, to dynamically customize system resource management in order to offer applications the best possible environment in which to execute. Such dynamic adaptation allows operating systems to modify the execution environment in response to changes in workload behavior and system state. The main challenges of this project included determination of what operating system (OS) algorithms, policies, and parameters should be adapted, when to adapt them, and how to adapt them. We addressed these challenges by using a combination of static analysis and runtime monitoring and adaptation to identify a priori profitable targets of adaptation and effective heuristics that can be used to dynamically trigger adaptation. Dynamic monitoring and adaptation of the OS was provided by either kernel modifications or the use of KernInst and Kperfmon (Wm04). Since Linux, an open source OS, was our target OS, patches submitted by kernel developers and researchers often facilitated kernel modifications. KernInst operates on unmodified commodity operating systems, i.e., Solaris and Linux; it is fine-grained, thus, there were few constraints on how the underlying OS can be modified. Dynamically adaptive functionality of operating systems, both in terms of policies and parameters, is intended to deliver the maximum attainable performance of a computational environment and meet, as best as possible, the needs of high-performance applications running on extreme scale systems, while meeting system constraints.
NTIS
Computer Techniques; Kernel Functions; Heuristic Methods

20100019549 Purdue Univ., West Lafayette, IN USA
Continuous Energy, Multi-Dimensional Transport Calculations for Problem Dependent Resonance Self-Shielding
Downar, T.; Mar. 31, 2009; 35 pp.; In English
Contract(s)/Grant(s): FG07-05ID14695
Report No.(s): DE2010-951326; DOE/OE-14695; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall objective of the work here has been to eliminate the approximations used in current resonance treatments by developing continuous energy multi-dimensional transport calculations for problem dependent self-shielding calculations. The work here builds on the existing resonance treatment capabilities in the ORNL SCALE code system.
NTIS
Energy Transfer; Computer Programs; Algorithms

20100019575 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Technische Univ., Eindhoven, Netherlands
Formal Aspects of Component Software
Meng, S.; Schatz, B.; Nov. 2009; 222 pp.; In English
Report No.(s): PB2010-108126; SEN-E0902; Copyright; Avail.: National Technical Information Service (NTIS)

This report is contained in the proceedings of the 6th International Workshop on Formal Aspects of Component Software (FACS09). FACS09 was held in Eindhoven, the Netherlands, on November 2-3, 2009, as a satellite event of the Formal Methods Week.
NTIS
Formalism; Computer Programming; Software Engineering

20100019577 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Amsterdam Univ., Netherlands
Semi-Bracketed Contextual Grammars
Kuppusamy, L.; Dec. 2008; 16 pp.; In English
Report No.(s): PB2010-108122; SEN-R0808; Copyright; Avail.: National Technical Information Service (NTIS)

Bracketed and fully bracketed contextual grammars were introduced to bring the concept of a tree structure to the strings by associating a pair of parentheses to the adjoined contexts in the derivation. In this paper, we show that these grammars fail to generate all the basic noncontext-free languages, thus cannot be a syntactical model for natural languages. To overcome this failure, we introduce a new class of fully bracketed contextual grammars, called the semi-bracketed contextual grammars, where the selectors can also be non-minimally Dyck covered language. We see that the tree structure to the derived strings is still preserved in this variant. When this new grammar is combined with the maximality feature, the generative power of these grammars is increased to the extent of covering the family of context-free languages and some basic non-context-free languages, thus possessing many properties of the so called 'MCS formalism'.
NTIS
Grammars; Context Free Languages; Data Structures; Syntax

20100019579 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Parameter Estimation for a Model of Gap Gene Circuits with Time-Variable External Inputs in Drosophila
Ashyraliyev, M.; May 2009; 36 pp.; In English
Report No.(s): PB2010-107600; MAS-E0904; Copyright; Avail.: National Technical Information Service (NTIS)

We study a model for spatio-temporal pattern formation of gap gene products in the early development of Drosophila. In contrast to previous studies of gap gene circuits, our model incorporates a number of proteins as time-variable external inputs, including a protein Huckebein which is necessary for setting up the correct posterior domain boundary and its shift in time for the gap gene hunchback. Unknown model parameters are inferred by fitting the model outputs to the gap gene data and statistical analysis is applied to investigate the quality of the parameter estimates. Our results, while being consistent with previous findings, at the same time provide a number of improvements. Firstly, it takes into account correct regulation of hunchback at the posterior part of the embryo. Secondly, confidence interval analysis shows that the regulatory topology of the gene network in our model which consists of parameters representing the regulation between genes is more consistent with the experimental evidences. Our results also reveal that for data fitting the Weighted Least Squares sum is a more suitable measure than the Ordinary Least Squares sum which has been used in all previous studies. This is confirmed by a better fit of the boundaries of the gap gene expression domains and an absence of patterning defects in the model outputs, as well as by a correct prediction of mutant phenotypes.
NTIS
Circuits; Drosophila; Genetics; Mathematical Models; Parameter Identification

20100020128 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Computable CTL for Discrete-Time and Continuous-Space Dynamic Systems
Collins, P. J.; Zapreev, I. S.; Feb. 2009; 18 pp.; In English
Contract(s)/Grant(s): MAS2.2
Report No.(s): PB2010-107597; MAS-E0903; Copyright; Avail.: National Technical Information Service (NTIS)

Dynamic systems are widely applied for modelling and analysis in physiology, biology, chemistry and engineering. The high-profile and safety-critical nature of such applications has resulted in a large amount of work on formal methods for dynamic systems: mathematical logics, computational methods, formal verification, and etc. In our work, we focus on the verification approach called model checking, and its computability aspects. In this approach, a desired system property, specified using some logical formalism, is verified against the dynamic-system model via an exhaustive state-space exploration. This process typically involves computation of reachable and/or chain-reachable sets that in certain cases can not be obtained due to the continuity of state-space domain. Therefore, in this paper, we use topological approach along with the computability results of Type Two theory of Effectivity in order to construct a computable CTL semantics for discrete-time and continuous-space dynamic systems.
NTIS
Aerospace Systems; Program Verification (Computers); Space Exploration; Dynamic Models; Formalism

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20100018817 National Oceanic and Atmospheric Administration, Ann Arbor, MI USA
A Wireless Internet-Based Observatory: The Real-time Coastal Observation Network (ReCON)
Ruberg, S A; Muzzi, R W; Brandt, S B; Lane, J C; Miller, T C; Gray, J J; Constant, S A; Downing, E J; Sep 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518218; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518218

ReCON, a coastal observation network with nodes on Lakes Michigan, Huron, and Erie, has been designed to allow flexible deployment of coastal access points and simplified integration of sensor packages. The system provides continuous observations of chemical, biological, and physical parameters, facilitates modification of sampling parameters in anticipation of episodic events, facilitates collection of field samples in response to episodic events, supports long term research and contributes to sensor and system development. The system currently supports projects addressing harmful algal bloom (HAB) detection, human health observations related to beach closures and drinking water processing concerns, rip current warnings, integrated ecosystem assessment, and public access to historic shipwrecks at the Thunder Bay National Marine Sanctuary. ReCON system development relies on wireless broadband technology and a network-based underwater hub designed to allow expansion via satellite nodes. The system architecture allows simplified integration of sensors from various institutions through guest ports. Access to and control of instrumentation is made available to the scientific community and educational institutions through the internet. A real-time database management system provides data and information for forecast model initial conditions, forecast verification, public information, and educational outreach. The technology demonstrated on the ReCON project represents an important contribution to the success of regional coastal ocean observing systems. The pervasiveness of wireless internet technology in coastal regions represents an opportunity to significantly expand high bandwidth coastal observation capabilities.
DTIC
Architecture (Computers); Coasts; Internets; Real Time Operation

20100018977 Purdue Univ., West Lafayette, IN USA
Systematic Control and Management of Data Integrity, Quality and Provenance for Command and Control Applications
Bertino, Elisa; Jan 24, 2010; 18 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0041
Report No.(s): AD-A518609; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project is to design and develop a comprehensive approach to the problem of assuring high data integrity able to support data analysis and decision making. The project has achieved the several novel results: (l) Digital signatures techniques for graph and tree structured data; the techniques are both hiding and binding, that is, they assure integrity without releasing information (unlike the Merkle hash tree technique that leaks information). (2) Efficient privacy-preserving data matching protocols; these protocols use a combination of data sanitization techniques, like differential privacy, with secure multi-party computation techniques. (3) A model to assess the trustworthiness of data based also on provenance information; the model has been applied to sensor data and location data. (4) An assessment of the use of sanitized data for classification tasks: through extensive experiments, we have shown that classifiers obtained from sanitized data are usually good. (5) A system to enforce application-defined integrity policies and its implementation on top of the ORACLE DBMS.
DTIC
Command and Control; Data Transmission; Reliability; Security

20100019003 California Univ., Berkeley, CA USA
ThreadedComposite: A Mechanism for Building Concurrent and Parallel Ptolemy II Models
Lee, Edward A; Dec 7, 2008; 20 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019
Report No.(s): AD-A518665; UCB/EECS-2008-151; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the usage patterns of the ThreadedComposite actor in Ptolemy II. This actor enables the execution

of opaque actors (atomic actors or composite actors with directors) in a separate thread, thus providing multi-threading for models of computation that are not already multi-threaded. It can be used to execute an actor in the background, to execute multiple actors in parallel (e.g. on a multicore machine), and to execute actors that block on I/O operations without blocking other actors.
DTIC
Composite Structures; Concurrent Engineering; Parallel Processing (Computers)

20100019734 California Univ., Berkeley, CA USA
Sparse Signal Sampling using Noisy Linear Projections
Reeves, Galen; Jan 7, 2008; 62 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0076
Report No.(s): AD-A519085; UCB/EECS-2008-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519085

In many engineering applications we choose to view the world (an unknown signal) through a set of samples. Often, a relatively small number of samples tells us all we need to know. For example, the classical Whittaker-Nyquist-Kotelnikov-Shannon sampling theorem states that a continuous-time band-limited signal can be perfectly reconstructed from uniformly spaced discrete samples provided that the sampling rate (number of samples per time) is greater than twice the signal bandwidth. This fact is crucial to the analog-to-digital conversion in signal processing and telecommunications. For a more general notion of what it means to sample a signal, we may consider a variety of interesting applications where the signals of interest are not band-limited. In fact, even more can be said when we consider that sometimes the information we desire is not an unknown signal per se, but rather some function of it. Examples from the past decade include spectrum blind sampling (Bresler et al. [1, 2, 3]), sampling with a finite rate of innovation (Vetterli et al [4]) and compressed sensing (Donoho [5] and Candes & Tao [6], and many others). In particular, the field of compressed sensing deals with the digital-to-digital sampling of signals that are somehow compressible. For many such signals, the sampling processes simultaneously senses (provides a set of samples sufficient to reconstruct an unknown signal) and compresses (the number of samples is far less than the dimension of the original signal).
DTIC
Analog to Digital Converters; Sampling; Signal Processing; Telecommunication

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20100018530 Texas Univ., Austin, TX, USA
Synthesis of Greedy Algorithms Using Dominance Relations
Nedunuri, Srinivas; Smith, Douglas R.; Cook, William R.; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 97-108; In English; Second NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018530

Greedy algorithms exploit problem structure and constraints to achieve linear-time performance. Yet there is still no completely satisfactory way of constructing greedy algorithms. For example, the Greedy Algorithm of Edmonds depends upon translating a problem into an algebraic structure called a matroid, but the existence of such a translation can be as hard to determine as the existence of a greedy algorithm itself. An alternative characterization of greedy algorithms is in terms of dominance relations, a well-known algorithmic technique used to prune search spaces. We demonstrate a process by which dominance relations can be methodically derived for a number of greedy algorithms, including activity selection, and prefix-free codes. By incorporating our approach into an existing framework for algorithm synthesis, we demonstrate that it could be the basis for an effective engineering method for greedy algorithms. We also compare our approach with other characterizations of greedy algorithms.
Author
Greedy Algorithms; Optimization; Searching

20100018550 NASA Ames Research Center, Moffett Field, CA, USA

Software Model Checking of ARINC-653 Flight Code with MCP

Thompson, Sarah J.; Brat, Guillaume; Venet, Arnaud; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 171-181; In English; NASA Formal Methods Symposium, 13-15 Apr. 2010, Washington D.C., USA; See also 20100018529; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018550

The ARINC-653 standard defines a common interface for Integrated Modular Avionics (IMA) code. In particular, ARINC-653 Part 1 specifies a process- and partition-management API that is analogous to POSIX threads, but with certain extensions and restrictions intended to support the implementation of high reliability flight code. MCP is a software model checker, developed at NASA Ames, that provides capabilities for model checking C and C++ source code. In this paper, we present recent work aimed at implementing extensions to MCP that support ARINC-653, and we discuss the challenges and opportunities that consequentially arise. Providing support for ARINC-653 s time and space partitioning is nontrivial, though there are implicit benefits for partial order reduction possible as a consequence of the API s strict interprocess communication policy.

Author

Program Verification (Computers); Software Reliability; Computer Programming; Software Engineering; Computer Programs

20100018661 Bureau International des Poids et Mesures, Sevres, France

TWSTFT Data Treatment for UTC Time Transfer

Jiang, Z; Lewandowski, W; Konate, H; Nov 2009; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517806

TWSTFT (TW) is the primary technique of time and frequency transfers used at BIPM for the UTC/TAI generations. At present, some 19 laboratories operate a TW facility and 12 of them are officially used in practice. The latter contribute more than two-thirds of the atomic clocks and almost all the primary frequency standards to UTC and TAI. In addition to its major role, as a precise and an independent technique to GNSS, TW is used to evaluate the new GNSS techniques. In fact, all the recent GNSS techniques finally used in UTC/TAI transfers have been approved by the comparisons with TW, such as GPS P3, GPS All in View, GPS PPP, etc. A pilot study on the GLONASS time transfer is undertaking at BIPM and again TW is an indispensable tool. Unlike the earlier publications discussing the technical details in TW, this paper focuses rather on the data treatment performed at BIPM: raw data collection, detection of outliers in the raw data, the calibration, the interpolation methods, and the link comparison with other techniques, as well as the availability of the raw and treated data sets on the Web. The authors would like the transparency of BIPM work to be helpful to the whole timing communication. It is pointed in the end that TW and GPS PPP are each complementary and the combination of the two techniques will further improve the quality of the UTC time transfer.

DTIC

Data Acquisition; Data Processing; Frequencies; Frequency Standards; Time Measurement

20100018667 Maryland Univ., College Park, MD USA

Of Ivory and Smurfs: Loxodontan MapReduce Experiments for Web Search

Lin, Jimmy; Metzler, Donald; Elsayed, Tamer; Wang, Lidan; Nov 2009; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): IIS-0836560; IIS-0916043

Report No.(s): AD-A517816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517816

This paper describes Ivory, an attempt to build a distributed retrieval system around the open-source Hadoop implementation of MapReduce. We focus on three noteworthy aspects of our work: a retrieval architecture built directly on the Hadoop Distributed File System (HDFS), a scalable Map-Reduce algorithm for inverted indexing, and webpage classification to enhance retrieval effectiveness.

DTIC

Data Management; Distributed Processing; Information Retrieval

20100018779 National Standard Time and Frequency Lab., Taoyuan, Taiwan, Province of China

The Timing Activities of the National Time and Frequency Standard Laboratory of the Telecommunication Laboratories, CHT Co. Ltd., Taiwan

Chang, P C; Wang, J L; Lin, H T; Lin, S Y; Tseng, W H; Lin, C C; Chu, F D; Liao, C S; Nov 2009; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518095

The Telecommunication Laboratories (TL) has provided timing for Taiwan since 1969. Its Master Clock (MC) is the source of UTC (TL), TL's realization of Coordinated Universal Time (UTC), which has stayed within 30 ns of UTC during these years and within 15 ns in the past 12 months. The data used to generate UTC (TL) and TA (TL) are based upon 14 cesium and two hydrogen maser frequency standards in four electro-magnetic wave shielding rooms and TL's time scaling algorithm. TL disseminates time via speaking clock, Taiwan's computer time service (TCTS), telecom lease line, Network Time Protocol (NTP), GPS, and Two-Way Satellite Time and Frequency Transfer (TWSTFT). To meet future needs of precision, accuracy, and robustness for UTC (TL), TL rebuilt the air conditioner system of the clock rooms and their monitor system. The new system could maintain temperature and humidity of clock rooms within 23 0.3 deg C and 50 plus or minus 5%, respectively. This paper also describes some of the changes being made recently for international and domestic time transfer in future development.

DTIC

Frequency Standards; Taiwan; Telecommunication; Time Measurement

20100018780 National Standard Time and Frequency Lab., Taoyuan, Taiwan, Province of China

Design and Implementation of a Time Source Selecting and Monitoring System for the Telephone Speaking Clock

Lin, Ching-Chiang; Chang, Po-Cheng; Wang, Jia-Lun; Lin, Shinn-Yan; Nov 2009; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518096; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518096

As an added-on system of the Time Synchronized Speaking Clock (TSSC), the time source selecting and monitoring system (TSMS) together with its design and implementation are major concerns in this paper. The service offered by the TSSC is generally called the 117 time service and the telephone number 117 seems to be a symbol of the national standard time in Taiwan, since it is used frequently by the public to calibrate their time machines. Due to its popularity in daily uses, it is very important to keep the system running smoothly and providing reliable time service. The paper describes how to construct TSMS, including two sub-systems. One is for multi-time signal source selection and the other for data monitoring and recording, which would strengthen reliability of the TSSC. Considering continuity of future development in TSMS, we chose UML (Unified Modeling Language) to express abstract concepts of the system behaviors and to generate its blueprint. Finally, TSMS has been successfully implemented according to this blueprint. At the present time, the system is in operation and actual monitoring data are collected and analyzed. Charts of round-trip delays and fluctuations of synchronized time signals could also be plotted. According to these results, we see that the system has indeed brought evident benefits to enhance reliability of the TSSC system.

DTIC

Clocks; Data Management; Taiwan; Telephones; Time Measurement; Time Signals

20100018790 Defence Science and Technology Organisation, Victoria, Australia

Jack Human Modelling Tool: A Review

Blanchonette, Peter; Jan 2010; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518132; DSTO-TR-2364; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518132

When evaluating the design of a workstation human factors practitioners have traditionally used a number of different approaches to assess the design, including two-dimensional drafting mannequins and physical mock ups. In the late 1960s, human modelling software became available, and aerospace and automotive manufacturers saw the potential for much of the design process to take place in a virtual environment. Modern human modelling tools include Jack and Ramsis. As part of Project MIS 872, the Defence Science and Technology Organisation was supplied with a copy of Jack. This report serves as a review of the base Jack tool (version 5.1), with specific focus on the features relevant to the assessment of seated workstations.

DTIC

Computer Programming; Software Engineering; Virtual Reality; Workstations

20100018811 Naval Postgraduate School, Monterey, CA USA

Defense and Homeland Security Applications of Multi-Agent Simulations

Lucas, Thomas W; Sanchez, Susan M; Martinez, Felix; Sickinger, Lisa R; Roginski, Jonathan W; Dec 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518206; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518206

Department of Defense and Homeland Security analysts are increasingly using multi-agent simulation (MAS) to examine national security issues. This paper summarizes three MAS national security studies conducted at the Naval Postgraduate School. The first example explores equipment and employment options for protecting critical infrastructure. The second case considers non-lethal weapons within the spectrum of force-protection options in a martitime environment. The final application investigates emergency (police, fire, and medical) responses to an urban terrorist attack. There are many potentially influential factors and many sources of uncertainty associated with each of these simulated scenarios. Thus, efficient experimental designs and computing clusters are used to enable us to explore many thousands of computational experiments, while simultaneously varying many factors. The results illustrate how MAS experiments can provide valuable insights into defense and homeland security operations.

DTIC

Computerized Simulation; Defense Program; Security; Simulation

20100018904 Massachusetts Inst. of Tech., Cambridge, MA USA

Architecting Science: Practical Tools for Architecting Flexible Systems

Hastings, Daniel E; Cummings, Mary L; Aug 31, 2009; 37 pp.; In English

Contract(s)/Grant(s): FA9550-06-01-0550

Report No.(s): AD-A518386; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Three areas of architecting science were investigated: (1) Tradespace exploration is a conceptual design tool used to compare thousands of designs. Flexibility, the ability to dynamically change systems to mitigate risk or leverage opportunity, is difficult to assess within static tradespaces. A metric to identify valuably flexible designs in a tradespace, Value Weighted Filtered Outdegree, was developed and applied to a satellite radar and ORS case, and shown to identify designs that would not have been identified with existing tradespace metrics. (2) One cited mechanism for accommodating uncertainty in design is to embed flexibility. A new framework was developed in the research to aid the design of a flexible system. Change propagation analysis was extended for analysis of systems with heterogeneous relationships between components, using filtered outdegree analysis to quantify flexibility. (3) Decision makers utilize multiple criteria and many levels of reasoning to understand complex multivariate data. They can be aided by direct-perception decision-support systems of configural rather than separable displays. An experiment compared performance across different levels of reasoning, finding that configural display promoted better performance and more efficient eye fixation patterns at the highest level of reasoning than the separable display, and was the subjective tool of choice.

DTIC

Decision Support Systems; Software Development Tools

20100018952 Naval Research Lab., Washington, DC USA

Anthropogenic Noise and the Marine Environment

Hillson, R; Shyu, H-J; Jan 2006; 5 pp.; In English

Report No.(s): AD-A518539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The impact of anthropogenic noise on the marine environment is a subject of increasing concern to the USA Navy. Sources of noise include ambient noise from ship traffic, acoustic sources such as air guns used in petroleum exploration, and active sonar operations conducted for military operations. The Navy has acknowledged that the use of active sonar was a contributing factor to the cetacean strandings in the Bahamas in March 2000. The Office of Naval Research (ONR) subsequently initiated the Effects of Sound on the Marine Environment (ESME) program to address these issues, and to explore comprehensive approaches for reducing the adverse effects of anthropogenic noise on the marine environment. NRL was designated as the ESME systems integrator, and during the process developed the ESME Software Workbench. The ESME workbench, written in MATLAB (trademark), integrates data sets and computer models contributed by the ESME team of experts in the areas of oceanography, underwater acoustic propagation, and marine mammal physiology and behavior. Complex simulations can be rapidly constructed from an underlying set of conceptual models. Models are incorporated for simulating active acoustic sources and for simulating marine mammal movements. (A simulated marine mammal will be

referred to as an animat.) Additional models are provided for estimating the received time series along an animat's track, and for predicting the animat's cumulative acoustic exposure.
DTIC
Ambience; Computerized Simulation; Marine Environments; Marine Mammals; Noise (Sound); Responses; Sonar; Underwater Acoustics

20100018955 Naval Postgraduate School, Monterey, CA USA
Study of Navy Recruiting Simulation Tool
Jones, Julia W; Mar 2010; 127 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518546; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study examines the knowledge, views, and experiences of Navy recruiters and recruiting supervisors regarding the Navy Recruiting Simulation Tool (NRST). Also known as SIMmersion, NRST is an interactive, role-playing program designed to boost a recruiter's confidence and skills by providing supplementary sales training beyond the classroom. The primary source of information is an online survey distributed in January 2010 to 5,139 Navy recruiters and recruiting supervisors. A total of 1,058 persons (21 percent) responded to the survey. The results of the survey show that 58 percent of Navy recruiters never use NRST; further, four out five feel that NRST has no positive impact on their confidence, sales skills, productivity, or time management. Additionally, fewer than one in four Navy recruiters rated NRST favorably on its usability. The responses of recruiting supervisors were very similar to those of Navy recruiters. These results suggest that NRST has not been adequately presented to Navy recruiters and recruiting supervisors, who are generally unfamiliar with its potential benefits. Negative views on usability are influenced largely by the program's lack of compatibility with existing platforms. Recommendations are offered to increase the awareness, understanding, and use of NRST.
DTIC
Computerized Simulation; Education; Navy; Simulation

20100018986 Naval Postgraduate School, Monterey, CA USA
Requirements Framework for the Software Systems Safety Review Panel (SSSTRP)
Berzins, Valdis; Rivera, Joey; Feb 10, 2010; 41 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518632; NPS-GSBPP-10-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes the research and progress made during FY09 at the Naval Postgraduate School on a Software Systems Safety Review Panel (SSSTRP) Requirements Framework. Accomplishments made in FY09 include the discovery of the primary causes for the high level of vendor failure rates during the SSSTRP process. Research showed that the lack of structure associated with the vendor-provided Technical Review Package (TRP) led to inconsistent documentation and standards in the SSSTRP process of evaluating the vendor's software safety risk. The development of a domain-specific Requirements Framework designed to work with the SSSTRP process will both help the vendor fully understand the measurable requirements for the TRP, and the SSSTRP members to understand the measurable standard by which the TRP is evaluated. This process should result in a reduction of SSSTRP failures.
DTIC
Computer Programming; Risk; Safety; Software Engineering

20100018994 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Flexible Computing Architecture for Real Time Skin Detection
Hornung, Matthew P; Mar 2010; 94 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-09ENG287
Report No.(s): AD-A518644; AFIT/GCE/ENG/10-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In both the Air Force and Search and Rescue Communities, there is a current need to detect and characterize persons. Existing methods use red-green-blue (RGB) imagery, but produce high false alarm rates. New technology in multi-spectral skin detection is better than the existing RGB methods, but lacks a control and processing architecture to make them efficient for real time problems. A number of applications require accurate detection and characterization of persons, human measurement and signature intelligence (H-MASINT), and SAR in particular. H-MASINT requires it for the detection of persons in images so other processing can be performed. It is useful in the SAR community as a method of finding persons partly obscured, in remote regions, and either living or deceased. We have developed a modular computing architecture to perform the acquisition and processing in real times, as well as separate programs to perform processing and analysis of images post-acquisition. The architecture is flexible, as one can easily add additional functionality to meet growing demands.

All programs were organized using a basic Model-View-Controller design, designed using Universal Modeling Language principles, and coded using a bottom-up approach. Based on the results we have presented in this thesis, image acquisition, processing, skin detection, viewing, and saving can be performed in real time, at nearly 10 fps. Not only does this support the SAR community, the Air Force now has a new capability to help address its H-MASINT mission.
DTIC
Architecture (Computers); Detection; Real Time Operation; Rescue Operations

20100019010 Naval Postgraduate School, Monterey, CA USA
Efficient XML Interchange (EXI) Compression and Performance Benefits: Development, Implementation and Evaluation
Snyder, Sheldon L; Mar 2010; 388 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518679; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense (DoD) Network-Centric data sharing strategy for the Global Information Grid (GIG) is to XMLize all data. The goal of this strategy is to ensure all data is visible, usable and interoperable, when and where needed, to accelerate decision cycles. However, this XML-based data approach comes at the cost of limiting real-time network edge device connectivity to the GIG because they are seldom able to meet the necessary bandwidth and processing requirements due to XML's intrinsic nature of being verbose and often complex to process. This research explores a powerful and robust solution to XML's network depth limits by means of the World Wide Web Consortium's (W3C) proposed alternative XML format, Efficient XML Interchange (EXI). The EXI format removes redundant tags and values from XML documents and encodes numeric content in a binary format. This format delivers significant file size savings and processing efficiencies compared to existing practices. The evolution of XML's path to EXI is summarized based on the results of the XML Binary Characterization (XBC) working group and the W3C's design points of XML. Followed are recommended steps for EXI development and enterprise integration, focusing on a public open source licensing philosophy. EXI algorithms are described with detailed explanations, Java code samples, and part-task test XML documents. Experiments are conducted evaluating the effectiveness of EXI for DoD tactical use and is followed with a recommended optimal EXI configuration. Several predictive models of EXI's performance are presented to enable potential EXI adopters a measurement tool of expected EXI benefit for various XML domains. This research concludes that for XML-based data, a doubling of bandwidth potential is achievable and CPU burdens minimized when EXI is applied.
DTIC
Document Markup Languages; High Level Languages

20100019033 Florida Univ., Gainesville, FL USA
Wave-Sediment Interaction in Muddy Environments: A Field Experiment
Sheremet, Alexandru; Mehta, Ashish J; Allison, Mead A; Jan 2007; 9 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0448; N00014-07-1-0756
Report No.(s): AD-A518767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of the proposed work is to study and describe quantitatively the interaction between wave, currents and seabed sediments in shallow water over a bed characterized by heterogeneous, mud-dominated sediments. This report includes two projects: 1. Wave-Sediment Interaction in Muddy Environments: A Field Experiment, funded by Coastal Geosciences, The Coastal Geosciences project includes a field experiment on the Atchafalaya shelf, Louisiana, in Years 1 and 2 (2007-2008) and a data analysis and modeling effort in Year 3 (2009). 2. A System for Monitoring Wave-Sediment Interaction in Muddy Environments, funded by The DURIP program.
DTIC
Atchafalaya River Basin (LA); Coasts; Field Tests; Mud; Ocean Bottom; Sampling; Sediments; Wave Interaction

20100019034 Woods Hole Oceanographic Inst., MA USA
Wave Propagation Across Muddy Seafloors
Elgar, Steve; Raubenheimer, Britt; Jan 2007; 9 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0461; N00014-02-1-0145
Report No.(s): AD-A518768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal is to develop field-verified models for the evolution of surface-gravity waves, allowing more skillful predictions of wave fields on continental shelves and enabling the estimation of characteristics of the seafloor from wave observations. The objective of the Wave Propagation Across Muddy Seafloors project is to develop, test, and improve models

for mud-induced dissipation of waves in shallow water. Specific goals are to: (1) Observe waves along a cross-shore transect spanning several km of the Louisiana inner shelf between about 5- and 1-m water depth; (2) Extend existing wave models to account for damping by mud; (3) Use the observations and models to test hypotheses for mud-induced damping, and (4) Calibrate, test, and improve the models by comparing their predictions with the observations. Additional objectives in FY07 included analysis of waves, currents, and morphological change onshore of complex shallow-water bathymetry dominated by two submarine canyons that extend nearly to the shoreline (the Nearshore Canyon Experiment, NCEX).
DTIC
Bathymeters; Canyons; Mud; Ocean Bottom; Wave Propagation

20100019053 California Univ., Berkeley, CA USA
PTIDES: A Programming Model for Distributed Real-Time Embedded Systems
Derler, Patricia; Feng, Thomas H; Lee, Edward A; Matic, Slobodan; Patel, Hiren D; Zheo, Yang; Zou, Jia; May 28, 2008; 13 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312
Report No.(s): AD-A518830; TR-UCB-EECS-2008-72; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe a programming model called PTIDES (Programming Temporally Integrated Distributed Embedded Systems), that extends the discrete-event model of computation with a carefully chosen relationship between real time and model time. PTIDES provides a framework for exploring a family of execution strategies for distributed embedded systems. Our objective in this paper is to present an execution strategy that 1) allows independent events to be processed out of time stamp order, 2) uses clock synchronization as a replacement for null message communication across distributed platforms, 3) defines a notion of when events are safe to process and 4) presents an implementation of a PTIDES model. This work puts forward an execution strategy that is aggressive in concurrent execution of events.
DTIC
Computer Programming; Real Time Operation

20100019194 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Approach to Large Scale Radar-Based Modeling and Simulation
Long, IV, Lester C; Mar. 2010; 118 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518515; AFIT/GE/ENG/10-14; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research presents a method of aggregating, or reducing the resolution, of a commonly available DoD simulation. It addresses the differences between varying levels of resolution and scope used in the Department of Defense's hierarchy of models pyramid. A data representation that aggregates engagement-level simulation data to use at a lower resolution level, the mission-level, is presented and analyzed. Two formats of implementing this data representation are developed and compared: the rigid cylinder format and the expanding tables format. The rigid cylinder format provides an intuitive way to visualize the data representation and is used to develop the theory. The expanding tables format expands upon the capabilities of the rigid cylinder format and reduces the simulation time. Tests are run to show the effects of each format for various combinations of engagement-level simulation inputs. A final set of tests highlight the loss in accuracy incurred from reducing the number of samples used by the mission-level simulation. These tests culminate the work by deriving a notional scenario, applying the data cylinder representation, and exploring the realistic problem of comparing accuracy and compuational constraints.
DTIC
Computerized Simulation; Hierarchies; Simulation

20100019195 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Analysis of a Rumor Routing Protocol with Limited Packet Lifetimes
Francik, Peter R; Mar. 2010; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518514; AFIT/GE/ENG/10-09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wireless sensor networks require specialized protocols that conserve power and minimize network traffic. Therefore, it is vitally important to analyze how the parameters of a protocol affect these metrics. In doing so, a more efficient protocol can be developed. This research evaluates how the number of nodes in a network, time between generated agents, lifetime of agents, number of agent transmissions, time between generated queries, lifetime of queries, and node transmission time affect a modified rumor routing protocol for a large-scale, wireless sensor network. Furthermore, it analyzes how the probability distribution of certain protocol parameters affects the network performance. The time between generated queries had the

greatest effect upon a network's energy consumption, accounting for 73.64% of the total variation. An exponential query interarrival distribution with a rate of 0.4 queries/second/node used 25.78% less power than an exponential distribution with a rate of 0.6 queries/second/node. The node transmission time was liable for 73.99% of the total variation in proportion of query failures. Of three distributions, each with a mean of 0.5 seconds, the proportion of query failures using a Rayleigh transmission time distribution was 14.23% less than an exponential distribution and 18.46% less than a uniform distribution. Lastly, 54.85% of the total variation in the mean proportion of time a node is uninformed was a result of the time between generated agents. The mean proportion of time a node is uninformed using an exponential agent interarrival distribution with a rate of 0.005 was 6.59% higher than an exponential distribution with a rate of 0.01.
DTIC
Computer Programming; Energy Consumption; Protocol (Computers); Software Engineering; Statistical Analysis

20100019200 Air Force Research Lab., Rome, NY USA
Retrofitting Cyber Physical Systems for Survivability through External Coordination
Xiao, Kun; Ren, Shangping; Kwiat, Kevin; Proceedings of the Hawaii International Conference on System Sciences (HICSS) (41st); Jan. 2008; 10 pp.; In English; Hawaii International Conference on System Sciences (HICSS) (41st), Jan. 2008, Bis Island, HI; Original contains color illustrations
Contract(s)/Grant(s): Proj-4519
Report No.(s): AD-A518486; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most Supervisory Control and Data Acquisition (SCADA) systems have been in operation for decades and they in general have 24x7 availability requirement, hence upgrading or adding new fault tolerant logic into the systems to sustain faults caused by cyber attacks when these systems evolve into a cyber environment is often difficult to achieve. In the proposed approach, an external coordination layer is constructed that only interfaces with the SCADA systems through events and separate from the process under control. The coordination layer is a combination of transparent management of fault-tolerant schemes of critical services of a SCADA system and a model for coordinating different critical services when faults caused by cyber attack occur in that system. In addition, security-related knowledge, such as cyber attack patterns and potential fatal states, etc., are also modeled and built into the coordination layer.
DTIC
Computer Programs; Computer Systems Design; Coordination; Data Acquisition; Fault Tolerance; Knowledge Based Systems; Retrofitting; Security; Warfare

20100019207 National Oceanic and Atmospheric Administration, Silver Spring, MD USA
C-MIST: An Automated Oceanographic Data Processing Software Suite
Pruessner, A.; Fanelli, P.; Paternostro, C.; Proceedings of the MTS/IEEE Oceans 2007 Conference, 2007; Sep. 2007; 6 pp.; In English; MTS/IEEE Oceans 2007 Conference, 29 Sep. - 3 Oct. 2007, Vancouver, Canada; Original contains color illustrations
Report No.(s): AD-A517736; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517736

We introduce an enterprise software suite to automate the processing of large-scale, large-volume current meter data for dissemination to the nation's maritime community. Currents Measurement Interface for the Study of Tides (C-MIST) is a web-based end-to-end state-of-the-art data management system to ingest, quality control, analyze, and disseminate water velocity and related data from coastal and estuarine collections. Using real-world case studies from Southeast Alaska and Galveston Bay we demonstrate how the various modules of the system allow oceanographers to apply their expertise in analyzing complex data to research natural phenomena.
DTIC
Data Management; Data Processing; Oceanographic Parameters

20100019208 Air Force Research Lab., Rome, NY USA; ITT Advanced Engineering and Sciences, Rome, NY, USA
Enhancing Image Processing Performance for PCID in a Heterogeneous Network of Multi-core Processors
Linderman, Richard; Spetka, Scott; Emeny, Susan; Fitzgerald, Dennis; Sep. 2009; 12 pp.; In English; Advanced Maui Optical and Space Surveillance Technologies Conference, 1-54 Sep. 2009, Maui, HI, USA; Original contains color illustrations
Report No.(s): AD-A517613; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517613

The Physically-Constrained Iterative Deconvolution (PCID) image deblurring code is being ported to heterogeneous

networks of multi-core systems. This paper reports results from experiments using the JAWS supercomputer at MHPCC and the Cell Cluster at AFRL in Rome, NY. The results compare approaches to parallelizing FFT executions across the Xeons and the Cell's Synergistic Processing Elements (SPEs) for frame-level image processing. Optimization of FFTs in the PCID code led to a decrease in relative processing time for FFTs. Profiling PCID version 6.2, about one year ago, showed the 13 functions that accounted for the highest percentage of processing were all FFT processing functions. They accounted for over 88% of processing time in one run on Xeons. FFT optimizations led to improvement in the current PCID version 8.0. A recent profile showed that only two of the 19 functions with the highest processing time were FFT processing functions. Timing measurements showed that FFT processing for PCID version 8.0 has been reduced to less than 19% of overall processing time. We are working toward a goal of scaling to 200-400 cores per job (1-2 imagery frames/core). Running a pair of cores on each set of frames assigned to a worker reduces latency by implementing multithreading FFT processing. These results support the next higher level of parallelism in PCID, where groups of frames each producing one resolved image are sent to cliques of cores in a round robin fashion. We are fine-tuning the PCID parallelization strategy to balance processing over Xeons and Cell BEs to find an optimal partitioning of PCID over the heterogeneous processors. Using a publication/subscription oriented information management system to implement a unified communications platform makes runs on large HPCs with thousands of intercommunicating cores more flexible and more fault tolerant. Techniques for adapting the code to single precision and performance results are reported.
DTIC
Data Processing; Heterogeneity; Image Processing; Parallel Processing (Computers)

20100019209 Air Force Research Lab., Rome, NY USA
Air Force Science & Technology Issues and Opportunities Regarding High Performance Embedded Computing
Linderman, Richard; Sep. 23, 2009; 40 pp.; In English; Annual Workshop (13th) on High Performance Embedded Computing (HPEC 2009), 22-23 Sep. 2009, Lexington, MA, USA; Original contains color illustrations
Report No.(s): AD-A517539; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517539

Challenges by Domain * Air: Persistent air dominance is at risk * Increasingly effective air defenses * Proliferation of 5th generation fighters, cheap cruise missiles, and UASs * Light-speed war possibilities are terrifying * Space: Now a contested domain * Increasingly important * Increasingly vulnerable * Cyber: Cyber warfare has begun * We don't control the battlespace * We rely on it more and more * We can't find the enemy.
DTIC
Architecture (Computers); Computer Networks; Embedding; Military Technology; Unmanned Aircraft Systems

20100019251 Air Force Research Lab., Mesa, AZ USA
Mindmodeling at Home. . . and Anywhere Else You Have Idle Processors
Harris, Jack; Gluck, Kevin; Mielke, Thomas; Moore, Larry R., Jr.; Proceedings of the Ninth International Conference on Cognitive Modeling; July 2009; 3 pp.; In English; 9th International Conference on Cognitive Modeling, 24-26 Jul. 2009, Manchester, UK, UK
Contract(s)/Grant(s): FA8650-05-D-6502; Proj-2313; 61102F
Report No.(s): AD-A518643; AFRL-RH-AZ-PR-2009-0004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As we, the ICCM community, continue to expand the scope of our cognitive modeling ambitions, we increasingly face computational requirements that are an impediment to progress. Computational complexity grows quickly with increases in the granularity of models, the fidelity of the models' operating environment, and the time scales across which these models interact. Additional processing demands are encountered when studying the breadth of a cognitive model's performance capabilities such as through observing the model's sustained fitness while varying the environment or conducting sensitivity analyses of interactions between internal model parameters in a controlled experiments. Such computational demands are not unique to the cognitive modeling community. Other scientific fields (bioinformatics, meteorology, physics, etc.) have already pioneered a variety of platforms and methodologies for dealing with similarly computationally complex problems. We will achieve faster progress toward the broader scientific objectives of cognitive modeling and the specific goals of particular research projects if we pay attention to the lessons learned and capabilities developed in other computational sciences.
DTIC
Cognition; Computer Networks; Distributed Processing; Models

20100019357 Air Force Research Lab., Wright-Patterson AFB, OH USA

Mixed- and Homogeneous-Culture Military Team Performance on a Simulated Mission: Effects of Age, Computer-Game Experience and English Proficiency

Warren, Rik; NATO-RTO-MP-HFM-142; Feb. 2008, pp. 14-26; In English; Adaptability in Coalition Teamwork Symposium held in Copenhagen, Denmark on 21-23 April 2008, 21-23 Apr. 2008, Copenhage, Denmark

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A518440; AFRL-RH-WP-TP-2010-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Abilities; Age Factor; Computerized Simulation; English Language; Evaluation; Human Factors Engineering; Human Performance; System Effectiveness; Teams

20100019372 Biometrics Task Force, Arlington, VA USA

Department of Defense: Electronic Biometric Transmission Specification. Version 2.0

Mar. 27, 2009; 300 pp.; In English

Report No.(s): AD-A518194; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518194

This Department of Defense (DoD) Electronic Biometric Transmission Specification (EBTS) is based on the American National Standards Institute (ANSI)/National Institute of Standards and Technology (NIST) Information Technology Laboratory specification number 1-2007 (ITL 1-2007). The DoD's EBTS builds upon the ITL 1-2007 to meet DoD requirements via additions to and customizations of the ITL 1-2007 data format. The DoD EBTS was originally developed as an interface to the DoD Automated Biometric Identification System (ABIS). The DoD ABIS is an electronic database and an associated set of software applications that support the storage, retrieval, and searching of fingerprint and latent data collected from persons of national security interest. The DoD ABIS was designed to be similar to the FBI Criminal Justice Information Services (CJIS) Integrated Automated Fingerprint Identification System (IAFIS) and therefore its interface was based on the FBI's Electronic Fingerprint Transmission Specification (EFTS). Because of the different nature of DoD encounters and detainment circumstances, the DoD has additional operational requirements beyond those defined in the FBI EFTS. The DoD-unique capabilities are defined in the DoD EBTS. Following extensive expert review and multiple revisions, the first widely distributed version (version 1.2) of the DoD EBTS was released in November 2006. That document described a set of capabilities that had been implemented in the DoD Biometric Enterprise as well as defining future capabilities. DoD EBTS version (v) 1.2 was based on the FBI Electronic Fingerprint Transmission Specification (EFTS) v7.0 and ANSI/NIST-ITL 1-2000. Since the release of DoD EBTS v1.2, a number of events have necessitated a new version of the DoD EBTS-version 2.0.

DTIC

Biometrics; Computer Programs; Defense Program

20100019410 Office of Naval Research, Arlington, VA USA

A Generative Decision Support Architecture (GDSA)

Lange, Doug; Cowen, Mike; St John, Mark; Jan 15, 2002; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517728

OBJECTIVE: Develop an agent generation architecture for decision support applications. * Improve the tie between cognitive task analysis and software development * Lessen the time necessary for developing decision support software * Improve the quality of decision support software * Provide the flexibility necessary to support NCW * Provide a method to evaluate an agent contribution to decision support.

DTIC

Decision Support Systems; Mental Performance; Computer Programs; Tasks

20100019641 Air Force Research Lab., Mesa, AZ USA

An 'Active Vision' Computational Model of Visual Search for Human-Computer Interaction

Halverson, Tim; Hornof, Anthony J; Jan 2009; 76 pp.; In English

Report No.(s): AD-A518836; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518836

Visual search is an important part of human-computer interaction (HCI). The visual search processes that people use have

a substantial effect on the time expended and likelihood of finding the information they seek. This work investigates visual search through computational cognitive modeling of empirical data. Computational cognitive modeling is a powerful methodology that uses computer simulation to capture, assert, record, and replay plausible sets of interactions among the many human processes at work during visual search. This work aims to provide a cognitive model of visual search that can be utilized by predictive interface analysis tools and to do so in a manner consistent with a comprehensive theory of human visual processing, namely active vision. The model accounts for the four questions of active vision: What can be perceived in a fixation? When do the eyes move? Where do the eyes move? What information is integrated between eye movements? The answers to these questions are important to both practitioners and researchers in HCI. This work presents a principled progression of the development of a computational model of active vision. Three sets of data were modeled in the EPIC (Executive Process-Interactive Control) cognitive architecture. This work extends the practice of computational cognitive modeling by (a) providing the first detailed instantiation of the theory of active vision in a computational framework and (b) informing the process of developing computational models through the use of eye movement data. This instantiation allows us to better understand how these visual search processes can be used computationally to predict people's visual search behavior. The development of a comprehensive model ultimately benefits HCI by giving researchers and practitioners a better understanding of how users visually interact with computers, and provides a foundation for tools to predict that interaction.
DTIC

Computerized Simulation; Eye Movements; Human-Computer Interface

20100019707 California Univ., Berkeley, CA USA

Heterogeneous Concurrent Modeling and Design in Java (Volume 3: Ptolemy II Domains)

Bhattacharyya, Shuvra S; Brooks, Christopher; Cheong, Elaine; Davis, II, John; Goel, Mudit; Kienhuis, Bart; Lee, Edward A; Leung, Man-Kit; Liu, Jie; Liu, Xiaojun; Muliadi, Lukito; Neuendorffer, Steve; Reekie, John; Smyth, Neil; Tsay, Jeff; Vogel, Brian; Williams, Winthrop; Xiong, Yuhong; Zhao, Yang; Zheng, Haiyang; Apr 15, 2008; 173 pp.; In English

Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312

Report No.(s): AD-A519010; UCB/EECS-2008-37-VOL-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519010

This volume describes Ptolemy II domains. The domains implement models of computation, which are summarized in chapter 1. Most of these models of computation can be viewed as a framework for component- based design, where the framework defines the interaction mechanism between the components. Some of the domains (CSP, Rendezvous, DDE, and PN) are thread-oriented, meaning that the components implement Java threads. These can be viewed, therefore, as abstractions upon which to build threaded Java programs. These abstractions are much easier to use (much higher level) than the raw threads and monitors of Java. Others (CT, DE, SDF) of the domains implement their own scheduling between actors, rather than relying on threads. This usually results in much more efficient execution. The Giotto domain, which addresses real-time computation, is not threaded, but has concurrency features similar to threaded domains. The FSM domain is in a category by itself, since in it, the components are not producers and consumers of data, but rather are states. The non-threaded domains are described first, followed by FSM and Giotto, then the threaded domains followed by two newer domains, HDF and DDF. Volume 1 is an introduction to Ptolemy II, including tutorials on use of the software, and volume 2 describes the Ptolemy II software architecture.
DTIC

Architecture (Computers); Computer Programming; Computer Programs; Computerized Simulation; Domains; Heterogeneity; Java (Programming Language)

20100019715 California Univ., Berkeley, CA USA

Heterogeneous Concurrent Modeling and Design in Java (Volume 2: Ptolemy II Software Architecture)

Brooks, Christopher; Lee, Edward A; Liu, Xieojun; Neuendorffer, Stephen; Zhao, Yang; Zheng, Haiyang; Bhattacharyya, Shuvra S; Cheong, Elaine; Davis, II, John; Goel, Mudit; Kienhuis, Bart; Leung, Man-Kit; Liu, Jie; Muliadi, Lukito; Reekie, John; Smyth, Neil; Tsay, Jeff; Vogel, Brian; Williams, Winthrop; Xiong, Yuhong; Apr 1, 2008; 241 pp.; In English

Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312

Report No.(s): AD-A519025; UCB/EECS-2008-29-VOL-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519025

This volume describes the software architecture of Ptolemy II. The first chapter covers the kernel package, which provides a set of Java classes supporting clustered graph topologies for models. Cluster graphs provide a very general abstract syntax

for component-based modeling, without assuming or imposing any semantics on the models. The actor package begins to add semantics by providing basic infrastructure for data transport between components. The data package provides classes to encapsulate the data that is transported. It also provides an extensible type system and an interpreted expression language. The graph package provides graph-theoretic algorithms that are used in the type system and by schedulers in the individual domains. The model transformation package provides a mechanism to systematically transform models by means of graph rewriting. The plot package provides a visual data plotting utility that is used in many of the applets and applications. The codegen package is a templated based code generator similar to the Ptolemy Classic code generators. The copernicus package is a code generator that performs static analysis on Java class files to produce smaller, faster executable models. Volume 1 gives an introduction to Ptolemy II, including tutorials on the use of the software, and volume 3 describes the domains, each of which implements a model of computation.
DTIC
Architecture (Computers); Computer Programming; Computer Programs; Heterogeneity; Java (Programming Language)

20100019732 California Univ., Berkeley, CA USA
Heterogeneous Concurrent Modeling and Design in Java (Volume 1: Introduction to Ptolemy II)
Brooks, Christopher; Lee, Edward A; Liu, Xiaojun; Neuendorffer, Stephen; Zhao, Yang; Zheng, Haiyang; Bhattacharyya, Shuvra S; Cheong, Elaine; Davis, II, John; Goel, Mudit; Kienhuis, Bart; Leung, Man-Kit; Liu, Jie; Muliadi, Lukito; Reekie, John; Smyth, Neil; Tsay, Jeff; Vogel, Brian; Williams, Winthrop; Xiong, Yuhong; Apr 1, 2008; 305 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312
Report No.(s): AD-A519074; UCB/EECS-2008-28-VOL-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519074

This volume describes how to construct Ptolemy II models for web-based modeling or building applications. The first chapter includes an overview of Ptolemy II software, and a brief description of each of the models of computation that have been implemented. It describes the package structure of the software, and includes as an appendix a brief tutorial on UML notation, which is used throughout the documentation to explain the structure of the software. The second chapter is a tutorial on building models using Vergil, a graphical user interface where models are built pictorially. The third chapter discusses the Ptolemy II expression language, which is used to set parameter values. The next chapter gives an overview of actor libraries. These three chapters, plus one of the domain chapters, will be sufficient for users to start building interesting models in the selected domain. The fifth chapter gives a tutorial on designing actors in Java. The sixth chapter describes the Ptolemy coding style, The seventh chapter explains MoML, the XML schema used by Vergil to store models. And the eighth chapter, the final one in this part, explains how to construct custom applets. Volume 2 describes the software architecture of Ptolemy II, and volume 3 describes the domains, each of which implements a model of computation.
DTIC
Architecture (Computers); Computer Programming; Computer Programs; Heterogeneity; Java (Programming Language); Mathematical Models

20100019738 National Defense Univ., Washington, DC USA
JLASS: Celebrating 25 Years of Educating Future Leaders
Connors, Sean R; Ogren, Theodore P; Jan 2008; 5 pp.; In English
Report No.(s): AD-A519100; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519100

The academic year is well under way at the Services' senior level colleges (SLCs). At each college, an elective course is entering its 25th year of educating the Nation's future leaders of strategic and operational art. That course is the Joint Land, Aerospace, and Sea Simulation (JLASS). The centerpiece of this unique course, which focuses on joint campaign planning and execution, is a dynamic unscripted wargame set 10 years in the future. Designed to challenge tomorrow's strategic leaders and thinkers, JLASS continues to be the only course offered and jointly run by all joint professional military education (JPME) SLCs. Over 100 students participate in JLASS each year, and over 1,000 have benefited since its inception.
DTIC
Aerospace Environments; Education; Leadership; Seas; Universities

20100019740 Johns Hopkins Univ., Laurel, MD USA
Enhanced Worldwide Ocean Optics Database
Smart, Jeffrey H; Jan 2008; 9 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0257
Report No.(s): AD-A519104; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519104

The long-term objective is to provide a comprehensive worldwide optics database that includes data on a broad range of important optical properties, including diffuse attenuation, beam attenuation, and scattering. Data from ONR-funded bio-optical cruises are given priority for loading into the database, but data from other scientific programs (NASA, NODC, NSF) and from other countries will also be routinely added to the Worldwide Ocean Optics Database (WOOD). The database shall be easy to use, Internet accessible, and frequently updated with data from recent at-sea measurements. The database shall be capable of supporting a wide range of applications, such as environmental assessments, sea test planning, and Navy applications. The database shall include derived optical parameters so that if measured data are not available, the user can obtain values computed from empirical algorithms (e.g., beam attenuation estimated from diffuse attenuation and backscatter data). Uncertainty estimates will also be provided for the computed results.
DTIC
Data Bases; Internets; Oceans; Wood

20100019756 California Univ., Berkeley, CA USA
Predictable Programming on a Precision Timed Architecture
Lickly, Ben; Liu, Isaac; Kim, Sungjun; Patel, Hiren D; Edwards, Stephen A; Lee, Edward A; Apr 18, 2008; 21 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312
Report No.(s): AD-A519148; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519148

In a hard real-time embedded system, the time at which a result is computed is as important as the result itself. Modern processors go to extreme lengths to ensure their function is predictable, but have abandoned predictable timing in favor of average-case performance. Real-time operating systems provide timing-aware scheduling policies, but without precise worst-case execution time bounds they cannot provide guarantees. We describe an alternative in this paper: a SPARC-based processor with predictable timing and instruction-set extensions that provide precise timing control. Its pipeline executes multiple, independent hardware threads to avoid costly, unpredictable bypassing, and its exposed memory hierarchy provides predictable latency. We demonstrate the effectiveness of this precision-timed (PRET) architecture through example applications running in simulation.
DTIC
Scheduling; Timing Devices

20100019780 Naval Surface Warfare Center, Bethesda, MD USA
SeaFrame. From Research to Reality Supporting the Fleet. Volume 4, Issue 3, 2008
Jan 2008; 37 pp.; In English
Report No.(s): AD-A519219; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519219

SEAFRAME is the official publication of the Naval Surface Warfare Center, Carderock Divisor. It is published quarterly with appropriated funds in accordance with NAVSO-P35. Articles concern all aspects of naval operations including marine engineering, software engineering, and technology innovations.
DTIC
Computer Programming; Marine Technology; Military Operations; Navy; Software Engineering; Warfare

20100019883 Science Applications International Corp., McLean, VA USA
Enhanced Resources of the SMDC Monitoring Research Program for Source Information and Data Acquisition
Bahavar, Manochehr; Barker, Brian W; Bennett, Theron J; Bowman, J R; Israelsson, Hans; Kohl, Ben; Kung, Yu-Long; Murphy, Jack R; North, Robert G; Oancea, Victoria; O'Brien, Mike; Shields, Gordon; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DASG60-03-C-0009
Report No.(s): AD-A519368; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Research and Development Support Services (RDSS) project of the Space and Missile Defense Command (SMDC)

provides a range of resources and services for use in nuclear explosion monitoring research and development R&D. This presentation focuses on recent developments and enhancements to the infrasound, seismic, and hydroacoustic resources, most of which can be accessed from the RDSS website at www.rdss.info. In particular, on-going and recent developments and improvements are related to (1) the nuclear explosion database archive and (2) infrasound signals and associated source information. The RDSS project has traditionally maintained an archive of information on source metadata and seismic waveforms from worldwide nuclear explosions. These resources were previously documented in the year 2000, and we are now completing a major revision and update which includes newly published or revised information about historical explosions, access to additional or corrected waveform data for some explosions, and new data from more recent nuclear tests (e.g., North Korea). In addition to maintaining these research data archives, we have been developing a number of web tools which enable visualization of and easier access to these explosion resources, including tabular-, map-, and imagery-based event selection and comparisons, station coverage and response information, as well as review of data quality and acquisition of the available seismic waveform data. Identification of infrasound events for the RDSS infrasound database has continued. This is based on a search of the RDSS waveform archive for signals that can be associated with recent events from seismic bulletins, volcanic activity reports, and reports in the press of accidental explosions, bolides, etc. Signal processing with Infratool and simple modeling with InfraMap are also used in the association.
DTIC
Computer Programs; Data Acquisition; Data Bases; Infrasonic Frequencies; Nuclear Explosions; Signal Processing; Underwater Acoustics

20100019905 Cornell Univ., Ithaca, NY USA
Scalable Simulations of Dynamics of Relationships
Gehrke, Johannes; Jan 2009; 12 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0437
Report No.(s): AD-A519428; OSP-53525; No Copyright; Avail.: Defense Technical Information Center (DTIC)
With funding from this project, we addressed the following research problems: The application of database principles to large-scale behavioral simulations. As the military expands its mission into new areas such as domestic disaster recovery, largescale simulations of individual behavior are important tools for analyzing how best to address these situations. However, behavioral simulations are often complex, and do not scale enough to cover the population of a major urban area. How can we leverage the technology from massively scalable database systems to produce efficient large-scale behavioral simulations? A language for expressing efficient large-scale behavioral simulations. Defining a large-scale simulation in a database query language like SQL is prohibitively complex; there is no way to isolate or encapsulate individual behavior. What language features do we need to translate behavioral simulations of individuals into database query plans? New algorithms for processing large-scale simulations. The types of database query plans that correspond to large-scale simulations are likely very different from traditional database query plans. What new algorithms can we develop specifically to optimize these types of query plans?
DTIC
Data Bases; Programming Languages; Simulation

20100019953 Mitre Corp., McLean, VA USA
SA2 101
Fitzgerald, Gerry; Mar 4, 2010; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519525; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The SATCOM Availability Analyst (SA2) is a software application originally built for SPAWAR PMW 176, now included in AESOP, and also fielded by USCG. SA2 allows SATCOM operators to determine, for any location, heading, and sea state, what SATCOM systems are available given superstructure blockage and elevation angle constraints. It provides real-time Situation Awareness to shipboard SATCOM operators, in an extremely simple display which has already seen months of at-sea testing and refinement, including in combat. It also allows SATCOM planners to develop global statistics for the availability of Line of Sight (LOS) for specific constellations and topside designs, taking ship motion into account. It supports mission planners in optimizing satellite cutovers.
DTIC
Satellite Communication; Software Development Tools

20100020040 High Performance Computing Modernization Program, Arlington, VA USA

High-Performance Computing and Test and Experimentation

Henry, Cray J; Jul 2005; 4 pp.; In English

Report No.(s): AD-A519790; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Today, scientists and engineers are just beginning to use science-based simulation to virtually design, test, and evaluate new ideas and systems. Organizations all across the Department of Defense (DoD) are changing their business processes to take advantage of simulation-based processes enabled by supercomputers and parallel software. Many members of the T&E community saw the potential benefits nearly a decade ago, and today these T&E leaders are working with improved capabilities. For example, the use of supercomputers and science-based software has transformed the stores certification process. Air Force and Navy test engineers are using supercomputers to augment current ground testing techniques and to reduce open-air flight-testing, resulting in faster stores certifications and reduced certification costs. Computational science, specifically computational fluid dynamics (CFD) running on supercomputers, is used to predict aerodynamic loads for aircraft stores before, during and after release. This capability has been used extensively in certifying new aircraft-weapons combinations prior to deployment in Afghanistan and Iraq. The Arnold Engineering Development Center used its high-performance computing (HPC) resources to assist in the design of the Joint Strike Fighter (JSF) engine inlet. Using CFD, Lockheed-Martin was able to model and analyze the complex flows at the inlet, thus supporting a quick design and test cycle. HPC also has been used to assist in the development of the JSF Key Performance Parameters for the Operational Requirements Document. Using supercomputers at the ARL Major Shared Resource Center, simulations were run to evaluate add-on blast protection for the Stryker wheeled vehicle to lessen the danger from improvised explosive device blasts and fragmentation. The Javelin Integrated Test and Simulation Network (JITSN) is a hardware-in-the-loop test facility, made possible through the use of supercomputers.

DTIC

Computerized Simulation; Defense Program; Evaluation; Interoperability; Parallel Processing (Computers); Research and Development; Supercomputers; System Effectiveness; Technologies; Test Facilities

20100020208 Vistology, Inc., Framingham, MA USA

Semantic Information eXchange Architecture (SIXA)

Matheus, Christopher J; Kokar, Mieczyslaw; Moskal, Jakub; Hanson, Geoff; Mar 31, 2010; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0367

Report No.(s): AD-A519041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519041

The Semantic Information eXchange Architecture Project (SIXA) funded joint effort between VIStology, Inc., Referentia Systems, Inc. and Northeastern University. The main accomplishments of this work include the: 1. Design and partial development of the SIXA Semantic Web Service. 2. Development of translation scripts to transform JC3IEDM into OWL ontology. 3. Development of suspicious activity scenario, ontology and supporting simulated data. 4. Integration of SIXA with XCOP and the demonstration of its use in detecting suspicious activity. 5. Design and development of the SIXA AIS Processing Platform (SAPP). 6. Design and development of the LiveKB framework for the intelligent control of devices such as trackers. These primary accomplishments are summarized in this final report.

DTIC

Semantics; Internets

20100020216 Pacific-Sierra Research Corp., Arlington, VA, USA

Automatic and Interactive Analysis Software for Beta-Gamma Coincidence Systems Used in CTBT Monitoring

Rynes, J.; Biegalski, K. M. F.; Donohoe, P.; Biegalski, S.; Proceedings of the 22nd Annual DoD/DOE Seismic Research Symposium: Planning for Verification of and Compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT); September 2000; 10 pp.; In English; 22nd Annual DoD/DOE Seismic Research Symposium: Planning for Verification of and Compliance with the Comprehensive Nuclear-Test-Ban Treaty (CTBT), 13-15 Sep. 2000, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-99-C-0031

Report No.(s): AD-A518841; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518841

A suite of software has been developed by Veridian Systems as part of the Prototype International Data Center (PIDC) to assist in the analysis of noble gas monitoring data for the Comprehensive Nuclear-Test-Ban Treaty (CTBT). There are two

acceptable noble gas monitoring methods for CTBT verification purposes: high-resolution gamma-ray (-) spectrometry and beta-gamma (-) coincidence. Data from - spectrometry systems can be analyzed with the existing software at the PIDC and the International Data Center (IDC). Because commercially available software did not exist to analyze data from the - coincidence systems, this software has been developed at the PIDC for eventual deployment at the IDC. The suite of software consists of automatic analysis software and CORIANT (COincident Radiation Interactive ANalysis Tool). The automatic analysis software automatically identifies and quantifies radionuclides present in the sample and categorizes the sample based on the type and quantity of radionuclides present. CORIANT is a graphical user interface that gives an analyst the capability to view three-dimensional Beta-gamma coincidence data, view automatic analysis results, view temporal trends in the data, generate reports, and override the automatic analysis if needed. A general description of the automatic analysis software and CORIANT, and the implementation of this software at the PIDC are discussed in this paper.
DTIC
Computer Programs; Gamma Rays; Graphical User Interface; Software Engineering

20100020225 City Coll. of the City Univ. of New York, NY USA
A Delay Tolerant Networking Architecture for Airborne Networking
Saadawi, Tarek; April 2010; 31 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-09-1-0158; Proj-558B; 62702F
Report No.(s): AD-A518780; AFRL-RI-RS-TR-2010-095; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518780

In this work we present our recent results of the novel Delay Tolerant Networking (DTN)-based probabilistic routing approach to achieve reliable communication in Airborne Networking (AN) environment associated with intermittent connectivity. The challenge is to find a routing algorithm that can deal with dynamic environment causing networks to split and merge due mainly to nodes mobility, the nature of the wireless channel jamming effect and . The new approach utilizes a DTN technique with the concept of the history of encounters to facilitate smooth information transfer between the heterogeneous nodes in Mobile Ad Hoc Network (MANET). We implement the DTN Architecture in AN environment where topology is changing rapidly because of weather, terrain, highly variable delay links, error rate links, and jamming. In our future work, the framework will include a study and analyze of the impact of the physical parameters on DTN routing protocols performance. Also, we will build a Cross Layer Design (CLD) framework that diminishes the impact of the physical layer parameters.
DTIC
Algorithms; Telecommunication

20100020314 Sandia National Labs., Albuquerque, NM USA
Advances in the Integration of Large Data Sets for Seismic Monitoring of Nuclear Explosions
Carr, Dorthe B.; Lewis, Jennifer E.; Ballard, Sandy; Martinez, Elaine M.; Hampton, Jeff W.; Merchant, Bion J.; Stead, Richard J.; Crown, Michelle; Roman-Nieves, Jorge; Dwyer, John J.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007, pp. 927-934; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-AC04-94AL8500; DE-AC52-06NA-25396
Report No.(s): AD-A519416; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Nuclear Security Administration (NNSA) Ground-Based Nuclear Explosion Monitoring Research and Engineering (GNEMRE) program has been integrating large sets of seismic events and their associated measurements for almost a decade to support nuclear explosion monitoring. During that time the integration process has changed significantly, generally becoming more complex and more automated as the number of events and the range of associated measurements has steadily grown. In this paper, we explain the methodology for integrating database tables from different products that are part of a Knowledge Base (KB) release. The major effort of KB integration is merging events and their associated information in Oracle database tables. We have developed a substantial foundation of structure and software to assure data integrity in the integration of diverse data sets. The structural part of this foundation utilizes Oracle data dictionary tables along with complementary custom database tables. These custom tables contain information specifically related to how KB database objects are built. Information such as descriptions and database types are stored in these custom tables so that the KB structure is easily modifiable making it more flexible than it would be following a traditional database design. This metadata of the supporting structures is called the schema schema, and all the integration tools are based on this structure. Los Alamos

National Laboratory (LANL) has developed a tool to make sure the information in the product database tables is accurate and valid. Called the Quality Control Tool (QCTool), this tool checks that the database tables conform to the database structures found in the schema schema and that the values in the database tables are reasonable. Database tables are not merged together until the errors generated by QCTool are either corrected or explained.
DTIC
Knowledge Based Systems; Nuclear Explosions

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20100018556 Southampton Univ., UK
Evaluation of a Guideline by Formal Modelling of Cruise Control System in Event-B
Yeganefard, Sanaz; Butler, Michael; Rezazadeh, Abdolbaghi; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 182-191; In English; See also 20100018529; Original contains black and white illustrations
Contract(s)/Grant(s): EU Proj. ICT 214158 DEPLOY; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018556

Recently a set of guidelines, or cookbook, has been developed for modelling and refinement of control problems in Event-B. The Event-B formal method is used for system-level modelling by defining states of a system and events which act on these states. It also supports refinement of models. This cookbook is intended to systematize the process of modelling and refining a control problem system by distinguishing environment, controller and command phenomena. Our main objective in this paper is to investigate and evaluate the usefulness and effectiveness of this cookbook by following it throughout the formal modelling of cruise control system found in cars. The outcomes are identifying the benefits of the cookbook and also giving guidance to its future users.
Author
Systems Engineering; Systems Analysis; Computer Systems Simulation

20100018671 Marine Corps Development and Education Command, Quantico, VA USA
First-Term Data Marines: Operating Forces or Supporting Establishment
Vega, L A; Feb 20, 2009; 13 pp.; In English
Report No.(s): AD-A517830; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517830

Since the arrival of the Navy and Marine Corps Intranet (NMCI) on 6 October 2000, data communication Marines have experienced a loss of responsibility with regard to daily computer network operations activities. The civilianization of the Marine Corps' garrison computer networks has relieved data communication Marines of the day-to-day responsibilities of computer network operations and administration to the extent that their skills are atrophying. Skills such as router configuration, domain controller configuration, and Internet Protocol (IP) addressing are perishable skills that are suffering in the supporting establishment. Consequently, assignment to a supporting establishment command, post-NMCI, will degrade their technical proficiency and tactical development. Marines assigned to the associated military occupational specialties (MOS) should begin their careers with a unit in the operating forces.
DTIC
Computer Networks; Data Transmission; Degradation; Military Personnel; Personnel Development

20100018706 Naval Postgraduate School, Monterey, CA USA
Exploiting a GSM Network for Precise Payload Delivery
Bourakov, Eugene A; Yakimenko, Oleg A; Slegers, Nathan J; May 7, 2009; 15 pp.; In English
Report No.(s): AD-A517936; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517936

This paper introduces the novel concept of using a GSM network for command of and communications with multiple aerial delivery systems. The research prototype of such a system, Snowflake-N, allows communicating with other network clients via a commercial Blackberry Curve 8310 handheld over a Bluetooth connection. A new architecture allows reassigning targets and sending other relevant commands (via web interface, by voice, data, or text messages) to an onboard autopilot,

which is within a network reach, from any place in the world. Similarly, a current position of the descending system and target assignment can be viewed from any computer connected to the Internet worldwide using a standard Google Earth viewer. The networking capability also allows uplinking the latest weather data measured by a portable target weather station, being a part of a network as well, and therefore drastically improving an accuracy of a payload delivery. The paper extends the previous work by the authors and introduces the current state of the Snowflake-N development. It presents a C2 concept for the aerial delivery systems, talks about communication protocols, presents the hardware set-up, components and results of recent drops. The paper ends with conclusions and recommendations for further development.
DTIC
Air Cargo; Delivery; Internets; Payloads; Portable Equipment; Protocol (Computers)

20100018800 National Defense Univ., Washington, DC USA
Terrorist Use of the Internet: The Real Story
Lachow, Irving; Richardson, Courtney; Jan 2007; 5 pp.; In English
Report No.(s): AD-A518156; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518156

Cyberterrorism conjures images of infrastructure failures, economic disasters, and even large-scale loss of life. It also receives a great deal of coverage in the press. While the threat of cyberterrorism is real, the hype surrounding the issue often outpaces the magnitude of the threat. In addition, the term itself deflects attention from a more mundane but equally serious problem: terrorist organizations effectively using the Internet to stymie U.S. efforts to win the Long War. The Internet enables terrorist groups to operate as either highly decentralized franchises or freelancers. Similar to information age businesses, these groups use the Internet to create a brand image, market themselves, recruit followers, raise capital, identify partners and suppliers, provide training materials, and even manage operations. As a result, these groups have become more numerous, agile, and well coordinated, all of which make them harder to stop. Furthermore, these groups have become expert at using the Internet to manipulate both public opinion and media coverage in ways that undermine American interests. In short, rather than attacking the Internet, terrorists are using it to survive and thrive. The Internet has five characteristics that make it an ideal tool for terrorist organizations. First, it enables rapid communications. Second, Internet use is a low-cost proposition. Third, the ubiquity of the Internet means that small terrorist groups can have a global cyber presence that rivals that of much larger organizations. Fourth, the growth in bandwidth combined with development of new software has enabled unsophisticated users to develop and disseminate complex information via the Internet. Finally, modern encryption technologies allow Internet users to surf the Web, transfer funds, and communicate anonymously -- a serious (though not insurmountable) impediment to intelligence and law enforcement organizations trying to find, track, and catch terrorists.
DTIC
Countermeasures; Internets

20100018828 Library of Congress, Washington, DC USA
Internet Domain Names: Background and Policy Issues
Kruger, Lennard G; Apr 5, 2010; 19 pp.; In English
Report No.(s): AD-A518237; CRS-97-868; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518237

Navigating the Internet requires using addresses and corresponding names that identify the location of individual computers. The Domain Name System (DNS) is the distributed set of databases residing in computers around the world that contain address numbers mapped to corresponding domain names, making it possible to send and receive messages and to access information from computers anywhere on the Internet. The DNS is managed and operated by a not-for-profit public benefit corporation called the Internet Corporation for Assigned Names and Numbers (ICANN). Because the Internet evolved from a network infrastructure created by the Department of Defense, the U.S. government originally owned and operated (primarily through private contractors) the key components of network architecture that enable the domain name system to function. A 1998 Memorandum of Understanding (MOU) between ICANN and the Department of Commerce (DOC) initiated a process intended to transition technical DNS coordination and management functions to a private-sector not-for-profit entity. While the DOC has played no role in the internal governance or day-to-day operations of the DNS, ICANN remained accountable to the U.S. government through the MOU, which was superseded in 2006 by a Joint Project Agreement (JPA). On September 30, 2009, the JPA between ICANN and DOC expired and was replaced by an Affirmation of Commitments (AoC), which provides for review panels to periodically assess ICANN processes and activities.
DTIC
Internets; Policies

20100018915 Army War Coll., Carlisle Barracks, PA USA
Leveraging Cyberspace in Counterinsurgency Operations
Webster, Aaron A; Mar 2010; 31 pp.; In English
Report No.(s): AD-A518424; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Military forces today are facing traditional, irregular, catastrophic, and disruptive challenges. U.S. military forces are conducting counterinsurgency operations (COIN) in populated neighborhoods amongst innocent people. The enemy is using insurgency and hybrid warfare to make it more difficult for the USA and coalition forces to employ kinetic weapon systems and technology. This paper argues that the use of cyberspace by insurgents is more prominent, lethal, and difficult to defeat. The paper will use operations in Afghanistan as a case study. First, this paper will provide background of how forces predominantly fought in the past and employed conventional weapons in Counterinsurgency operations. Second, the author will clearly define cyberspace and present an in-depth discussion into the employment techniques, challenges and advantages of this readily available technology. Next, the paper will discuss Computer Network Attack (CNA), Computer Network Defense (CND), agencies and in theater policies at the strategic level. Lastly, the paper will close with a few recommendations that provide techniques to safeguard theater networks, resources and means to limit the numerous cyber challenges.
DTIC
Computer Networks; Data Transmission; Internets; Security

20100018949 Naval Postgraduate School, Monterey, CA USA
Arizona Law Enforcement Biometrics Identification and Information Sharing Technology Framework
Kalaf, William M; Mar 2010; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since 9/11, Arizona and federal law enforcement agencies understand the need to improve subject identification capabilities and integrate criminal information across jurisdictions. Agencies still collect information based on a subject's name and demographics for identification. Using a subject's name and demographics as keys to identifying information is a weakness. In 2012, Arizona will upgrade the state's strategic plan to allow law enforcement officers to use biometrics technology to verify a subjects' identity at first point of contact and implement information sharing capability across the state, border states, and federal agencies. This thesis presents a technology framework for strategic planning that includes biometrics identification technology, information sharing capability, and a governance structure for oversight. Through researching implementations in Los Angeles County, California and the states Minnesota, Wisconsin, and Vermont a comparative analysis revealed similarities in each implementation that will be used in developing an Arizona technology framework. Biometrics identification and information sharing is critical for supporting security along the U.S. border with Mexico. This thesis addresses expansion of the technology framework to align with the FBI's Repository for Individuals of Special Concern, initiatives to gain access to identification information from Central American countries and programs developed during the border governors' conferences with Mexico.
DTIC
Biometrics; Information Systems; Law (Jurisprudence)

20100018963 Naval Postgraduate School, Monterey, CA USA
Network Exploration and Vulnerability Assessment Using a Combined Blackbox and Whitebox Analysis Approach
Meng, Patrick C; Mar 2010; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518575; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The increased reliance on advanced networking technologies to integrate cutting-edge capabilities has posed tremendous challenges in assuring user legitimacy and preserving the integrity of our network landscape. Without proper network accountability and holistic vulnerability assessment, insider threats can exploit the security vulnerabilities that result from creating an integrated system-of-systems. To detect security illegitimacies, such as unauthorized connections, network security administrators need to have a comprehensive network map to identify potential entry points. This thesis proposes a systematic way to combine black-box and white-box analysis for network exploration and vulnerability assessment. In the analytical model design, a modular approach is adopted to select tools and techniques from both analysis approaches. These tools and techniques are used to construct a network map based on a pre-defined set of criteria that define the type of essential network information to be annotated on the map. The black-box and white-box analysis approaches were found to be complementary. For example, black-box analysis was able to map active hosts and networking devices, but white-box analysis was able to detect those that are inactive or do not respond to pings. Moreover, black-box analysis provides a focal point for white-box

analysis approach to derive in-depth information regarding unauthorized connections.
DTIC
Data Transmission; Security; Vulnerability

20100019014 Naval Postgraduate School, Monterey, CA USA
Internet Service Provider Network Evolution in the Presence of Changing Environmental Conditions
Sanchez, Aaron; Mar 2010; 108 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518690; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Internet Service Providers (ISPs) offer access to the Internet and other network resources to their customers. The ISP marketplace is extremely competitive, requiring ISPs to provide their services with limited resources. In this thesis, we use constrained optimization to reflect the tensions between changing customer demands and infrastructure costs that the ISP faces in its investment decisions. Specifically, we model the traffic routing decisions, the investment in augmenting capacity decisions, and the investment in building network infrastructure decisions made by ISPs. We develop three models: a traffic engineering model, a network provisioning model, and a multi-period network provisioning model. To develop our experiments, we use a real ISP, the Abilene network. We focus primarily on explaining the factors that lead to changes in network performance and extract investment policies for ISPs to maximize the effectiveness of limited resources.
DTIC
Internets; Networks; Protocol (Computers); Traffic

20100019204 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
A Distributed Network Logging Topology
Fritts, Nicholas E; Mar, 2010; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518458; AFIT/GCO/ENG/10-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Network logging is used to monitor computer systems for potential problems and threats by network administrators. Research has found that the more logging enabled, the more potential threats can be detected in the logs. However, generally it is considered too costly to dedicate the manpower required to analyze the amount of logging data that it is possible to generate. Current research is working on different correlation and parsing techniques to help filter the data, but these methods function by having all of the data dumped in to a central repository. Central repositories are limited in the amount of data they are able to receive without losing some of the data. In large networks, the data limit is a problem, and industry standard syslog protocols could potentially lose data without being aware of the loss, potentially handicapping network administrators in their ability to analyze network problems and discover security risks. This research provides a scalable, accessible and fault-tolerant logging infrastructure that resolves the centralized server bottleneck and data loss problem while still maintaining a searchable and efficient storage system.
DTIC
Computers; Topology

20100019242 Judge Advocat General (Navy), Washington, DC USA
Solving the Dilemma of State Responses to Cyberattacks: A Justification for the use of Active Defenses Against States Who Neglect Their Duty to Prevent
Sklerov, Matthew J.; April 2009; 107 pp.; In English
Report No.(s): AD-A517821; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517821

The greatest advances in law, like those in science, come through imagination. When scientific knowledge fails to explain new discoveries about the universe, scientists advance new theories to account for their discoveries' so too with the law. Revolutions in technology, like the Internet, challenge the framework that regulates international armed conflict. Legal scholars must use imagination to find ways to tackle this problem. If not, the law will become obsolete and meaningless to the states that need its guidance. Man has long sought to regulate warfare. From the Chivalric Code to the U.N. Charter, man has placed restraints on the times one can resort to war and the methods with which it is conducted. There are a variety of reasons why, but, to generalize, regulations are the response to perceived problems with the state of war at a given time. Sometimes these perceptions are the result of shifts in the social conscience. At other times, values haven't changed at all, but problems arise due to radical changes in the way war is waged. As warfare changes, so must the law; and warfare is changing fast. Traditionally, the instruments of war were only controlled by states. However, in today's world of globally interconnected computer systems, non-state actors with a laptop computer and an Internet connection can attack the critical infrastructure of

another state from across the world. This is a major paradigm shift, which the law of war, today, fails to adequately address. This paper will explore the unique challenges that cyberattacks pose to the law of war and provide an analytical framework for dealing with them.
DTIC
International Law; Internets; Warfare

20100019570 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Common Data Format (CDF) and Coordinated Data Analysis Web (CDAWeb)
Candey, Robert M.; May 19, 2010; 1 pp.; In English; VISualize 2010: Second Annual Data Analysis and Visualization Symposium, 19-20 May 2010, Washington, DC, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Coordinated Data Analysis Web (CDAWeb) <http://cdaweb.gsfc.nasa.gov> data browsing system provides plotting, listing and open access via FTP, HTTP, and web services (REST, SOAP, OPeNDAP) for data from most NASA Heliophysics missions and is heavily used by the community. Combining data from many instruments and missions enables broad research analysis and correlation and coordination with other experiments and missions. Crucial to its effectiveness is the use of a standard self-describing data format, in this case, the Common Data Format (CDF) <http://cdf.gsfc.nasa.gov>, also developed at the Space Physics Data facility <http://spdf.gsfc.nasa.gov> , and the use of metadata standards (easily edited with SKTeditor <http://sscweb.gsfc.nasa.gov/skteditor/>). CDAweb is based on a set of IDL routines, CDAWlib <http://spdf.gsfc.nasa.gov/CDAWlib.html>. . The CDF project also maintains software and services for translating between many standard formats (CDF. netCDF, HDF, FITS, XML) <!<http://cdf.gsfc.nasa.gov/html/dtws.html>
Author
NASA Programs; Web Services; Data Systems; Data Structures

20100019647 California Univ., Berkeley, CA USA
Evaluating the Security of Machine Learning Algorithms
Barreno, Marco A; May 20, 2008; 129 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-02440; FA9550-07-1-0501
Report No.(s): AD-A518853; UCB/EECS-2008-63; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518853

Two far-reaching trends in computing have grown in significance in recent years. First, statistical machine learning has entered the mainstream as a broadly useful tool set for building applications. Second, the need to protect systems against malicious adversaries continues to increase across computing applications. The growing intersection of these trends compels us to investigate how well machine learning performs under adversarial conditions. When a learning algorithm succeeds in adversarial conditions, it is an algorithm for secure learning. The crucial task is to evaluate the resilience of learning systems and determine whether they satisfy requirements for secure learning. In this thesis, we show that the space of attacks against machine learning has a structure that we can use to build secure learning systems. This thesis makes three high-level contributions. First, we develop a framework for analyzing attacks against machine learning systems. We present a taxonomy that describes the space of attacks against learning systems, and we model such attacks as a cost-sensitive game between the attacker and the defender. We survey attacks in the literature and describe them in terms of our taxonomy. Second, we develop two concrete attacks against a popular machine learning spam filter and present experimental results confirming their effectiveness. These attacks demonstrate that real systems using machine learning are vulnerable to compromise. Third, we explore defenses against attacks with both a high-level discussion of defenses within our taxonomy and a multi-level defense against attacks in the domain of virus detection. Using both global and local information, our virus defense successfully captures many viruses designed to evade detection. Our framework, exploration of attacks, and discussion of defenses provides a strong foundation for constructing secure learning systems.
DTIC
Algorithms; Machine Learning; Security

20100019699 California Univ., Berkeley, CA USA
Security Inference from Noisy Data
Zhuang, Li; Apr 8, 2008; 122 pp.; In English
Contract(s)/Grant(s): FA9550-06-1-0244
Report No.(s): AD-A519001; UCB-EECS-2008-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519001

My thesis is that contemporary information systems allow automatic extraction of security-related information from large

amounts of noisy data. Extracting this information is the security inference problem: attackers or defenders extract information from noisy data that helps to compromise an adversary's security goals. I believe security inference is an important problem. Security inference often reveals a large amount of sensitive information that may be useful either to attackers or to system administrators. Attackers can use security inference to extract private information; system administrators can use security inference to determine the nature of attackers. Security inference is often a challenging problem because of the size and noisy nature of many real-world datasets. Our solution is to apply statistical analysis to this problem. We present two case studies that extract meaningful security knowledge from noisy data using statistical analysis. One goal is to explore selection of proper statistical analysis tools for security inference. The two case studies use a diverse set of statistical methods, which we believe to be applicable to other settings. We also propose a general framework for modeling security inference problems, which identifies key steps in the security inference process. In the first case study, we examine the problem of keyboard acoustic emanations.
DTIC
Computer Information Security; Crime; Extraction; Inference; Information Retrieval; Information Systems; Security

20100019702 Pennsylvania Univ., Philadelphia, PA USA
AS-CRED: Reputation Service for Trustworthy Inter-domain Routing
Chang, Jian; Venkatasubramanian, Krishna K; West, Andrew G; Kannan, Sampath; Lee, Insup; Loo, Boon T; Sokolsky, Oleg; Jan 2010; 13 pp.; In English
Contract(s)/Grant(s): N00014-07-1-0907
Report No.(s): AD-A519005; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519005

The current design of BGP implicitly assumes the existence of trust between ASes with respect to exchanging valid BGP updates. This assumption of complete trust is problematic given the frequent announcement of invalid - inaccurate or unnecessary - updates. This paper presents AS-CRED, a reputation service for ASes which quantifies the level of trust one can have with respect to its announcing valid updates. To compute the reputation, AS-CRED analyzes the past updates announced by each observable AS in the Internet, over a time-window, based on well-defined properties. It then classifies the resulting observations into multiple types of feedback. The feedback values are input into a mathematical function for computing AS reputation. The reputation is then used to track the instances of invalid updates announced in the Internet and trigger alerts. The contributions of the paper are: (1) a reputation service for ASes, characterizing their trustworthiness; (2) a set of well defined properties for analyzing AS behavior; (3) a simple reputation function and feedback mechanism; (4) a reputation portal which regularly publishes AS reputation; and (5) a reputation-based alert service which tracks potentially invalid updates in the Internet. Detailed analysis of AS-CRED demonstrates: (1) AS behavior is repetitive making reputation an effective trust metric, and (2) AS-CRED's alerts for invalid updates show an eight fold improvement over existing alert systems.
DTIC
Binding; Computer Networks; Protocol (Computers)

20100019723 Texas Univ., Dallas, TX USA
Storage, Retrieval, and Delivery of 3D Models and Multi-attribute Motion Data
Prabhakaran, Balakrishnan; Jan 23, 2010; 9 pp.; In English
Contract(s)/Grant(s): W911NF-05-1-0489
Report No.(s): AD-A519055; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519055

Content-based retrieval and delivery of 3D models and multi-attribute motion sequences facilitate several interesting applications for education and training of military personnel. It also can be helpful in providing the much needed coordination and support during field operations. These applications require integrated techniques for content-based retrieval and delivery of 3D data. For instance, layered representation of huge 3D models not only helps in progressive reconstruction on the client side during delivery over a network but also can help in efficient comparison during content-based retrieval from a 3D models repository. The research goal of this project is to develop a theoretical framework for: (i) Verification of data from 3D sensor sources; (ii) Fault tolerant, secure placement of 3D sensors; (iii) Error concealment approaches for streaming 3D models; (iv) Streaming 3D data over wireless networks. Prototypes will also be built using the developed framework for specific applications.
DTIC
Data Management; Three Dimensional Models

20100019934 Booz-Allen and Hamilton, Inc., Washington, DC USA

Cyber Strategic Inquiry: Enabling Change through a Strategic Simulation and Megacommunity Concept

Feb 2009; 11 pp.; In English

Report No.(s): AD-A519489; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cyber Strategic Inquiry 2008 (CSI'08), sponsored by Business Executives for National Security (BENS) and executed by Booz Allen Hamilton, brought together over 230 leaders from government, industry, and society to generate a shared knowledge of cybersecurity risks and potential solutions. CSI'08 provided participants the opportunity to examine the emerging threats to our nation's competitiveness in this network-based age as well as potential opportunities to address these challenges through a strategic simulation. The infrastructure and digital devices that contribute to our global leadership on many fronts are now a key target for criminals, potential adversaries, and malicious individuals. CSI'08 took place on 17 and 18 December, exposing participants to multiple, simultaneous situations and events that created confusion and doubt throughout society and demonstrated a widespread and serious impact on our nation's ability to function. CSI'08 identified several key insights: the unique nature of cybersecurity requires clear lines of authority for planning and executing the cyber mission; enhanced and updated legal frameworks are required to support the full-spectrum of cybersecurity challenges, including the balancing of privacy with information sharing; the complex, global and interconnected nature of the Internet may require an evolution in thinking about risk management and resilience; the complexity of the cyber threat requires a codified and flexible response plan to effectively manage cybersecurity and facilitate public awareness and education; greater and more instantaneous cooperation among government, industry, and society can enhance cybersecurity situational awareness; and cybersecurity solutions can be enhanced by leveraging innovative technologies and the unique capabilities of government, industry, academia, and the broader society.

DTIC

Organizations; Prevention; Protection; Security; Simulation; United States

20100019948 Cornell Univ., Ithaca, NY USA

Network-Centric Distributed Signal Processing

Tong, Lang; Sep 2009; 11 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0346

Report No.(s): AD-A519513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project investigates distributed signal processing in the context of sensor enhanced mobile ad hoc networks. The objective of the project is twofold. First, the research aims to create a new framework for Network Centric Signal Processing that facilitates a joint design of communications, networking, and signal processing optimized for specific applications. Second, for sensor networks deployed for detection and estimation, this research develops new multiaccess communication strategies, networking protocols (medium access control and routing), and centralized and decentralized signal detection and estimation algorithms.

DTIC

Communication Networks; Detectors; Distributed Processing; Signal Processing; Wireless Communication

20100019977 Air War Coll., Maxwell AFB, AL USA

Psychological Operations within the Cyberspace Domain

Baker, Prentiss O; Feb 17, 2010; 28 pp.; In English

Report No.(s): AD-A519576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To assist in achieving our political aims and the operational objectives of the Joint Force, we need a coherent integrated application of Information Operations across the range of military operations (e.g., peace, war, and stability operations) that encompasses all the domains -- air, sea, land, space, and cyberspace. Psychological Operations (PSYOP), one of the core capabilities of Information Operations, is critical to successful influence operations, and has been a vital part of warfare since ancient times. PSYOP is defined by the U.S. military as planned operations to convey selected truthful information and indicators to foreign audiences to influence their emotions, motives, objective reasoning, and ultimately, the behavior of their governments, organizations, groups, and individuals. Many great theorists and generals from Sun Tzu to Napoleon have emphasized the importance of waging Psychological Warfare. Before Psychological Operations' mission essential functions can be effectively employed within the cyberspace domain, one must understand the dynamics, opportunities and the vulnerabilities this domain offers. Joint Publication 1-02 defines cyberspace as a global domain within the information environment consisting of the interdependent network of information technology infrastructures, including the Internet, telecommunications networks, computer systems, and embedded processors and controllers. This domain presents some unique opportunities to influence, inform, and educate one's target audience. In this context the target audience is defined as

political and military decision makers, influential individuals, military personnel, armed factions, and specific population groups. The purpose of this Future Operating Concept (FOC) is to describe how future Joint Force Commanders can employ Psychological Operations' mission essential functions in the cyberspace domain to assist in accomplishing his/her operational objectives in the 2015-2020 time frame.
DTIC
Communication Networks; Computer Networks; Military Operations; Telecommunication

20100020151 NASA Marshall Space Flight Center, Huntsville, AL, USA
Virtualization in the Operations Environments
Pitts, Lee; Lankford, Kim; Felton, Larry; Pruitt, Robert; April 25, 2010; 1 pp.; In English; SpaceOps 2010, 25-30 Apr. 2010, Huntsville, AL, USA
Report No.(s): M10-0101; No Copyright; Avail.: Other Sources; Abstract Only

Virtualization provides the opportunity to continue to do 'more with less'---more computing power with fewer physical boxes, thus reducing the overall hardware footprint, power and cooling requirements, software licenses, and their associated costs. This paper explores the tremendous advantages and any disadvantages of virtualization in all of the environments associated with software and systems development to operations flow. It includes the use and benefits of the Intelligent Platform Management Interface (IPMI) specification, and identifies lessons learned concerning hardware and network configurations. Using the Huntsville Operations Support Center (HOSC) at NASA Marshall Space Flight Center as an example, we demonstrate that deploying virtualized servers as a means of managing computing resources is applicable and beneficial to many areas of application, up to and including flight operations.
Author
Virtual Reality; Software Engineering; Flight Operations; Lessons Learned; Computer Programs; Systems Engineering

20100020349 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA's Earth Science Data Systems - Lessons Learned and Future Directions
Ramapriyan, Hampapuram K.; March 29, 2010; 39 pp.; In English; U.S. Workshop on Roadmap Development for Digital Preservation Interoperability Framework, 29-31 Mar. 2010, Gaithersburg, MD, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020349

In order to meet the increasing demand for Earth Science data, NASA has significantly improved the Earth Science Data Systems over the last two decades. This improvement is reviewed in this slide presentation. Many Earth Science disciplines have been able to access the data that is held in the Earth Observing System (EOS) Data and Information System (EOSDIS) at the Distributed Active Archive Centers (DAACs) that forms the core of the data system.
CASI
Earth Observing System (EOS); Earth Sciences; EOS Data and Information System; NASA Programs; Satellite Observation

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CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20100018416 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
JPL Robotics Technology Applicable to Agriculture
Udomkesmalee, Suraphol Gabriel; Kyte, L.; January 21, 2008; 6 pp.; In English; National Council of Agricultural Employers, 21 Jan. 2008, Beltsville, MD, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41535

This slide presentation describes several technologies that are developed for robotics that are applicable for agriculture. The technologies discussed are detection of humans to allow safe operations of autonomous vehicles, and vision guided robotic techniques for shoot selection, separation and transfer to growth media,
CASI
Agriculture; Robotics; Robot Control; Technology Utilization

20100018682 National Inst. of Standards and Technology, Gaithersburg, MD USA
Evaluation Methods for Human-System Performance of Intelligent Systems
Scholtz, Jean; Aug 2002; 7 pp.; In English
Contract(s)/Grant(s): E710
Report No.(s): AD-A517868; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517868

Intelligent systems are becoming more and more of a reality but with the exception of very special purpose systems, completely autonomous systems are not yet the norm. In reality, we need to have humans who monitor the systems, intervening when necessary. As systems increase in intelligence, the goal for human-in-the-loop activities should not be to eliminate the human, but rather to create a human-system partnership with greater capabilities than the individual components. We currently view intelligent systems and the operators or supervisors of these systems as separate components and conduct evaluations in the same vein. For intelligent systems to become more useful and acceptable, we need to consider the system as a synergistic composition of software behaviors, possibly embedded in a physical component such as a robot, and the human interacting with this virtual or physical component. Our objective is to design this team interaction in such a way that the intelligence of the team is greater than the intelligence of any one of the parts.
DTIC
Human Performance; Robots

20100018801 Carnegie-Mellon Univ., Pittsburgh, PA USA
The Snackbot: Documenting the Design of a Robot for Long-term Human-Robot Interaction
Lee, Min K; Forlizzi, Jodi; Rybski, Paul E; Crabbe, Frederick; Chung, Wayne; Finkle, Josh; Glaser, Eric; Kiesler, Sara; Mar 2009; 9 pp.; In English
Contract(s)/Grant(s): IIS-0121426; IIS-0624275
Report No.(s): AD-A518162; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518162

This paper presents the design of the Snackbot, a robot that will deliver snacks in two of Carnegie-Mellon University's buildings. The robot is intended to provide a useful, continuing service and to serve as a research platform for long-term Human-Robot Interaction. Such research poses several technical, interaction, and design challenges. First, the robot must be robust and powerful enough to operate autonomously and interact with multiple users for extended periods of time. The technology should also be flexible enough to accommodate technical improvements and new applications. To test different approaches to human-robot interaction over time, researchers should be able to manipulate aspects of the robot's physical appearance and behavior. The authors are particularly interested in how a robot delivers a service after the initial novelty effect has worn off. The design process, which occurred over 24 months, is documented as a contribution for others in Human-Robot Interaction who may be developing social robots that offer services. They describe the phases of the design project, and the design decisions and tradeoffs that led to the current version of the robot. The paper contains the following subheadings: Context of Use; Design Goals; Snackbot Team; System Overview, including Hardware, Software, Form, and Interaction; Design Process, including Needs Analysis and Form Giving and Interaction Design; Second Prototype, including Housing, Tray, Internal Structure, Head and Face, and Interaction Design; and Lessons Learned.
DTIC
Design Analysis; Human Factors Engineering; Robots

20100018908 Army Tank-Automotive Research and Development Command, Warren, MI USA
Terrain Perception for Robot Navigation
Karlsen, Robert E; Witus, Gary; Apr 9, 2007; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518393; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents a method to forecast terrain trafficability from visual appearance. During training, the system identifies a set of image chips (or exemplars) that span the range of terrain appearance. Each chip is assigned a vector tag of vehicle-terrain interaction characteristics that are obtained from simple performance models and on-board sensors, as the vehicle traverses the terrain. The system uses the exemplars to segment images into regions based on visual similarity to the terrain patches observed during training, and assigns the appropriate vehicle-terrain interaction tag to them. This methodology will therefore allow the online forecasting of vehicle performance on upcoming terrain. Currently, the system uses a fuzzy c-means clustering algorithm for training. In this paper, we explore a number of different features for characterizing the visual

appearance of the terrain and measure their effect on the prediction of vehicle performance.
DTIC
Autonomous Navigation; Images; Navigation; Robots; Terrain

20100018931 Trideum Corp., Aberdeen, MD USA
Testing the Intelligence of Unmanned Autonomous Systems
Thompson, Miles; Jan 2008; 9 pp.; In English
Report No.(s): AD-A518471; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is a common misconception in the testing industry that all unmanned autonomous systems can be tested using methodologies developed to test manned systems. A tester can incorrectly state that driving a manned vehicle is conceptually identical to driving an unmanned vehicle; the only difference lies in the position of the operator. In actuality, the main difference lies in the unmanned autonomous system's role in the decision process. Because testers cannot make assumptions about the decision process within an unmanned autonomous system, there is a need for a methodology that completely tests this decision process without biasing the system into a default human solution. This article presents a comprehensive methodology for testing the intelligence of an unmanned autonomous system within a given set of requirements.
DTIC
Artificial Intelligence; Autonomy; Evaluation; Intelligence; System Effectiveness

20100019188 Space and Naval Warfare Systems Center, San Diego, CA USA
Automatic Payload Deployment System
Pezeshkian, Narek; Nguyen, Hoa G; Burmeister, Aaron; Holz, Kevin; Hart, Abraham; Apr. 9, 2010; 13 pp.; In English
Report No.(s): AD-A518722; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to precisely emplace stand-alone payloads in hostile territory has long been on the wish list of US warfighters. This type of activity is one of the main functions of special operation forces, often conducted at great danger. Such risk can be mitigated by transitioning the manual placement of payloads over to an automated placement mechanism by the use of the Automatic Payload Deployment System (APDS). Based on the Automatically Deployed Communication Relays (ADCR) system, which provides non-line-of-sight operation for unmanned ground vehicles by automatically dropping radio relays when needed, the APDS takes this concept a step further and allows for the delivery of a mixed variety of payloads. For example, payloads equipped with a camera and gas sensor in addition to a radio repeater, can be deployed in support of rescue operations of trapped miners. Battlefield applications may include delivering food, ammunition, and medical supplies to the warfighter. Covert operations may require the unmanned emplacement of a network of sensors for human-presence detection, before undertaking the mission. The APDS is well suited for these tasks. Demonstrations have been conducted using an iRobot PackBot EOD in delivering a variety of payloads, for which the performance and results will be discussed in this paper.
DTIC
Communication Networks; Deployment; Payloads; Robots

20100019198 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Improved Multispectral Skin Detection and its Application to Search Space Reduction for Dismount Detection Based on Histograms of Oriented Gradients
Brooks, Adam L; Mar. 2010; 183 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-09ENG287
Report No.(s): AD-A518510; AFIT/GE/ENG/10-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Due to the general shift from conventional warfare to terrorism and urban warfare by enemies of the USA in the late 20th Century, locating and tracking individuals of interest have become critically important. Dismount detection and tracking are vital to provide security and intelligence in both combat and homeland defense scenarios including base defense, combat search and rescue (CSAR), and border patrol. This thesis focuses on exploiting recent advances in skin detection research to reliably detect dismounts in a scene. To this end, a signal-plus-noise model is developed to map modeled skin spectra to the imaging response of an arbitrary sensor, enabling an in-depth exploration of multispectral features as they are encountered in the real world for improved skin detection. Knowledge of skin locations within an image is exploited to cue a robust dismount detection algorithm, significantly improving dismount detection performance and efficiency. This research explores multiple spectral features and detection algorithms to find the best features and algorithms for detecting skin in multispectral visible and short wave infrared (SWIR) imagery. This study concludes that using SWIR imagery for skin detection and color information for false alarm suppression results in 95% probability of skin detection at a false alarm rate of only 0.4%. Skin

detections are utilized to cue a dismount detector based on histograms of oriented gradients. This technique reduces the search space by nearly 3 orders of magnitude compared to searching an entire image, while reducing the average number of false positives per image by nearly 2 orders of magnitude at 95% probability of dismount detection. The skin-detection-cued dismount detector developed in this thesis has the potential to make significant contribution to the USA Air Force human measurement and signature intelligence and CSAR missions.
DTIC
Detection; Emittance; Histograms; Optical Properties; Personnel; Spectra

20100019373 Army War Coll., Carlisle Barracks, PA USA
The Collins Center Update. Volume 12, Issue 2, January-March 2010
Mar. 2010; 5 pp.; In English
Report No.(s): AD-A518180; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518180
Inside this issue: Strategic Decision, making Exercise 2010; Montenegro: Strategic Defense Review; War is War: Cyberspace Operations in the Contemporary Operational Environment; the Complexity of International Diplomacy; Strategic Force Planning and Development in the Armed Forces of Bosnia and Herzegovina.
DTIC
Military Operations; Planning; Warfare

20100019383 Naval Surface Warfare Center, Panama City, FL USA
Autonomous Underwater Vehicle (AUV) Fest 2007 Summary
Bernstein, Phillip J; Jan 2007; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518522; No Copyright; Avail.: Defense Technical Information Center (DTIC)
This paper will summarize the results of AUV Fest 2007. AUV Fest 2007 was hosted by the Naval Surface Warfare Center Panama City (NSWC PC) at the Naval Support Activity Panama City (NSA PC). This Sea Trial Project and FORCENet Enabling Demonstration was the largest in-water demonstration of unmanned underwater, surface, air and ground vehicles ever conducted. The event was sponsored by the Office of Naval Research (ONR). Six previous AUV Fests were conducted since the events were initiated in 1997.
DTIC
Autonomous Navigation; Autonomy; Underwater Vehicles

20100019400 Naval Postgraduate School, Monterey, CA USA
Public Key Infrastructure Utilization to Provide an Added Level of Authenticity to Transmitted Data
Blackmon, Jason B; Mar 2010; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518464; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Information Systems have a need for a level of security to protect the data when being transmitted from one user to another. This thesis points out a method of protecting data utilizing an end-to-end level of security. The idea is grounded in looking at the advantages provided with the Public Key Infrastructure applied to add a level of authenticity to the data on the receiving end of a transmission. The focus of this thesis is protecting data transmitted across the Internet via e-mail using end-to-end security. This thesis proves that applying PKI as data protection to the Information System Application Layer can be used to provide secure end-to-end connections and e-mail is the tool chosen for this thesis to accomplish this goal. The scope of this thesis is to identify authentic and/or confidential communication of data across an Internetwork. The variables to discuss are the ability to digitally sign and secure the data with the digital signature, establishing a connection to an unregulated network, and confirmation of delivery of the data by an alternate user computer. This thesis will focus on using a public key signature point out how this provides authenticity, with a bonus inclusion of the integrity.
DTIC
Cryptography; Signatures; Proving

20100019402 Army Tank-Automotive Research and Development Command, Warren, MI USA
Terrain Understanding for Robot Navigation
Karlsen, Robert E; Witus, Gary; Oct 29, 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518459; 17535; No Copyright; Avail.: Defense Technical Information Center (DTIC)
This paper presents a method to forecast terrain trafficability from visual appearance. During training, the system identifies

a set of image chips (or exemplars) that span the range of terrain appearance. Each chip is assigned a vector tag of vehicle-terrain interaction characteristics that are obtained from on-board sensors and simple performance models, as the vehicle traverses the terrain. The system uses the exemplars to segment images into regions, based on visual similarity to the terrain patches observed during training, and assigns the appropriate vehicle-terrain interaction tag to them. This methodology will therefore allow the online forecasting of vehicle performance on upcoming terrain. Currently, we are using fuzzy c-means clustering and exploring a number of different features for characterizing the visual appearance of the terrain.
DTIC
Autonomous Navigation; Detectors; Navigation; Robots; Terrain; Unmanned Ground Vehicles

20100019633 Washington Univ., Seattle, WA USA
How to Select a Good Training-data Subset for Transcription: Submodular Active Selection for Sequences
Lin, Hui; Bilmes, Jeff; Jan 2009; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-05-1-0388
Report No.(s): AD-A518795; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518795

Given a large un-transcribed corpus of speech utterances, we address the problem of how to select a good subset for word-level transcription under a given fixed transcription budget. We employ submodular active selection on a Fisher-kernel based graph over un-transcribed utterances. The selection is theoretically guaranteed to be near-optimal. Moreover, our approach is able to bootstrap without requiring any initial transcribed data, whereas traditional approaches rely heavily on the quality of an initial model trained on some labeled data. Our experiments on phone recognition show that our approach outperforms both average-case random selection and uncertainty sampling significantly.
DTIC
Education; Sequencing; Speech Recognition

20100019727 South Carolina Univ., Columbia, SC USA
New Graph Models and Algorithms for Detecting Salient Structures from Cluttered Images
Wang, Song; Feb 24, 2010; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-07-1-0250
Report No.(s): AD-A519062; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519062

This research was focused on developing new efficient algorithms to automatically detect structures of interest from cluttered images. The major accomplishments include: 1) a unified framework for edge grouping that can detect both open and closed boundaries from cluttered images, 2) a new graph model and algorithm to detect perceptually salient structures that show a certain level of boundary symmetry from cluttered images, 3) a new MCMC-based partial shape matching algorithm that can match two 2D shape contours with nonrigid shape deformation and multiple partial occlusions, 4) a new free-shape subwindow search algorithm for object localization that outperforms the state-of-the-art rectangle subwindow search algorithms, 5) two new perceptually motivated strategies for shape classification and recognition that leads to the new state-of-the-art recognition rate on the widely used MPEG7 shape data set, and 6) a new benchmark for more objective shape-correspondence performance evaluation along with a new shape-correspondence algorithm for statistical shape analysis that pre-organizes the given population of shape instances to achieve high correspondence accuracy using less CPU time.
DTIC
Algorithms; Detection; Image Processing; Imaging Techniques; Shapes

20100019926 Louisiana State Univ., Baton Rouge, LA USA
Memory-Based In Situ Learning for Unmanned Vehicles
McDowell, Patrick; Bourgeois, Brian S; Sofge, Donald A; Iyengar, S S; Jan 2006; 6 pp.; In English
Report No.(s): AD-A519469; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Researchers are using a sensor-input-based metric to develop a team of robots that would have the capability to learn their roles and improve strategies so that they can meet their overall goals in dynamic unstructured environments such as underwater or urban settings in which communications and monitoring are difficult. For a robot to operate autonomously in a dynamic environment, it must be capable of adapting itself without the help of humans. The ultimate goal of our research is to provide teams of unmanned underwater vehicles (UUVs) some of the abilities of animals to adapt to their environment using their memories, without requiring exhaustive trial-and-error testing or complex modeling of the environment. We focus

on UUVs because they offer the promise of making dangerous tasks such as searching for underwater hazards or surveying the ocean bottom more safe and economical for government and commercial operations. We adopt a team concept to reduce overall mission cost using several low-cost subordinate UUVs to augment the sensor capabilities of a higher-capability lead UUV. Our goal is to develop a team of robots that would have the capability to learn their roles and improve team strategies so that the team can meet its overall goals in dynamic unstructured environments such as underwater or urban settings in which communications and monitoring are difficult.
DTIC
Robots; Underwater Vehicles

20100019979 Army Research Lab., Aberdeen Proving Ground, MD USA
Enhancement of Target Contrast in Polarimetric Imagery Using Image Fusion
Felton, Melvin; Gurton, Kristan; Apr 2010; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519582; ARL-TR-5176; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have examined the use of two statistical/numerical image fusion techniques for polarimetric imagery that each allow for an objective analysis of the resultant data products. The first technique is principal component analysis (PCA), a standard multivariate image processing method used to redistribute the information within the data set and possibly reduce the dimensions of the data set. The second method fuses conventional thermal imagery with a novel data product, the enhanced degree-of-linear polarization (DOLP). We performed receiver operating characteristic (ROC) curve analysis to quantify the resultant contrast between the manmade objects in the scene and the natural backgrounds. We found that the PCA data products inconsistently conveyed the desired contrast information, and that ROC curve analysis is not well suited to quantify the contrast in the PCA imagery. On the other hand, fusing the conventional thermal and the enhanced DOLP images provided a robust data product that effectively combines the information provided by the sensor.
DTIC
Augmentation; Image Processing; Imagery; Linear Polarization; Polarimetry; Targets

20100019987 Minnesota Univ., Minneapolis, MN USA
Fast Image and Video Denoising via Non-Local Means of Similar Neighborhoods
Mahmoudi, Mona; Sapiro, Guillermo; Jun 2005; 6 pp.; In English
Report No.(s): AD-A519601; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this note, improvements to the non-local means image denoising method introduced in [2], [3] are presented. The original non-local means method replaces a noisy pixel by the weighted average of pixels with related surrounding neighborhoods. While producing state-of-the-art denoising results, this method is computationally impractical. In order to accelerate the algorithm, we introduce filters that eliminate unrelated neighborhoods from the weighted average. These filters are based on local average gray values and gradients, pre-classifying neighborhoods and thereby reducing the original quadratic complexity to a linear one and reducing the influence of less-related areas in the denoising of a given pixel. We present the underlying framework and experimental results for gray level and color images as well as for video.
DTIC
Algorithms; Image Processing

20100019991 Air War Coll., Maxwell AFB, AL USA
Future Operating Concept for Employing Electronic Warfare in the Cyberspace Domain
Van Brunt, David C; Feb 17, 2010; 34 pp.; In English
Report No.(s): AD-A519622; No Copyright; Avail.: Defense Technical Information Center (DTIC)

EW Operations Sequenced/Integrated With Other Io Capabilities Io is an integrating strategy. Therefore, EW will be utilized to influence an adversary's will and affect those capabilities enabling action. This can be to influence key decision makers or affect their technical capabilities to observe, orient, decide or act. To do so, EW must integrate fully with all joint operations to achieve maximum potential towards JFC objectives. Cyberspace necessitates EW planners not only coordinate with other aspects of JFC operations utilizing EM, but must also those conducting CNO. The route to achieving JFC effects is grounded in the physical and informational dimensions, that is, machines and data. Through these paths, EW significant affects on adversarial will. Integrating influence objectives with OPSEC, CNO, and CND presents cognitive realities for the adversary. These realities align with PSYOP plans to influence the adversary. Additionally, EW integration with media, PSYOP, CNO and OPSEC is integral to supporting MILDEC plans. Integrating these Io capabilities with all instruments of power will achieve JFC objectives. These integrated activities also must be specifically sequenced to rapidly support the JFC

via other kinetic and non-kinetic activities. EP will be closely sequenced with OPSEC and CND to protect the JFC's information environment. ES must be sequenced to support other kinetic/non-kinetic attacks and as MOE. Similarly, EA provides robust capabilities supporting kinetic operations when integrated within the JFC's fires plan. Achieving full potential of EW via Cyberspace will resemble the Chinese goal of Integrated Network Electronic Warfare which relies on simultaneous application of electronic warfare and computer network operations against an adversary's [C4ISR] networks and other essential information systems.
DTIC
Communication Networks; Decision Making; Electronic Warfare; Military Operations

20100020005 Army Research Lab., Aberdeen Proving Ground, MD USA
Intuitive Speech-based Robotic Control
Redden, Elizabeth S; Carstens, Christian B; Pettitt, Rodger A; Apr 2010; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519652; ARL-TR-5175; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We conducted a speech-based robotic control study using 29 Soldiers recruited from Fort Benning, GA. Findings indicated Soldiers were able to perform a secondary task (writing numbers) significantly faster when operating a robot using speech control versus using manual control. This demonstrated that robotic control requires multitasking and also implies that speech control requires less attention than manual control, thus freeing up cognitive resources for additional tasks. Speech control allowed significantly faster performance when the task involved using menu items (enlarge picture, shrink picture). Speech control allowed direct access to the menu items, whereas manual control required navigating through a menu and selecting an item two levels deep into the menu. Speech control was also significantly faster for labeling items where Soldiers had to choose and select from a list to label a picture. Alternatively, speech control took significantly longer when performing continuous tasks, such as turning the robot during the take a picture task and driving to the blue waypoint, which involved a significant amount of turning. When interpreting the results, one should consider that the intuition and speech-control portions of the experiment featured tasks that could be found in a robotic reconnaissance mission and the findings are specific to these tasks.
DTIC
Control; Robotics; Speech Recognition

20100020178 Survivability/Vulnerability Information Analysis Center, Wright-Patterson AFB, OH USA
Human Systems Integration (HSI) in Acquisition. HSI Domain Guide
Carr, Larr; Greene, Frances; August 2009; 195 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519020; AFHSIO-005; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519020
Human Systems Integration (HSI) encompasses the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. HSI processes facilitate trade-offs among human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. The human-centered domains with recognized application to HSI include: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Environment, Safety, Occupational Health, and Habitability.
DTIC
Systems Engineering; Systems Integration

20100020183 Survivability/Vulnerability Information Analysis Center, Wright-Patterson AFB, OH USA
Human Systems Integration (HSI) in Acquisition. Acquisition Phase Guide
Carr, Larry; Greene, Frances; August 2009; 185 pp.; In English
Report No.(s): AD-A519019; AFHSIO-004; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519019
Human Systems Integration (HSI) encompasses the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. HSI processes facilitate trade-offs among human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. The human-centered domains with recognized application to HSI include: Manpower, Personnel,

Training, Human Factors Engineering, Survivability, Environment, Safety, Occupational Health, and Habitability.
DTIC
Systems Engineering; Systems Integration

20100020184 Survivability/Vulnerability Information Analysis Center, Wright-Patterson AFB, OH USA
Human Systems Integration (HSI) in Acquisition. Management Guide
Carr, Larry; Greene, Frances; August 2009; 42 pp.; In English
Report No.(s): AD-A519018; AFHSIO-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519018

Human Systems Integration (HSI) encompasses the interdisciplinary technical and management processes for integrating human considerations within and across all system elements; an essential enabler to systems engineering practice. HSI processes facilitate trade-offs among human-centric domains without replacing individual domain activities, responsibilities, or reporting channels. The human-centered domains with recognized application to HSI include: Manpower, Personnel, Training, Human Factors Engineering, Survivability, Environment, Safety, Occupational Health, and Habitability.
DTIC
Systems Engineering; Systems Integration

20100020275 Air Force Research Lab., Wright-Patterson AFB, OH USA
Measurement of gamma prime Precipitates in a Nickel-Based Superalloy using Energy-Filtered Transmission Electron Microscopy Coupled With Automated Segmenting Techniques
Tiley, J. S.; Viswanathan, G. B.; Shiveley, A.; Tschopp, M.; Srinivasan, R.; Fraser, H. L.; Banerjee, R.; January 2010; 16 pp.; In English
Contract(s)/Grant(s): FA8650-08-C-5226; Proj-4347; 62102F
Report No.(s): AD-A519441; AFRL-RX-WP-TP-2010-4051; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Precipitates of the ordered L1(sub 2) gamma prime phase (dispersed in the face-centered cubic or FCC gamma matrix) were imaged in Rene 88 DT, a commercial multicomponent Ni-based superalloy, using energy filtered transmission electron microscopy (EFTEM). Imaging was performed using the Cr, Co, Ni, Ti and Al elemental L-edges in the energy loss spectrum. Manual and automated segmentation procedures were utilized for identification of precipitate boundaries, measurement of precipitate sizes and overall area fractions. The automated region growing technique for precipitate identification in images was determined to accurately measure precipitate diameters. In addition, the region growing technique provided a repeatable method for optimizing segmentation techniques for varying EFTEM conditions.
DTIC
Energy Transfer; Heat Resistant Alloys; Measuring Instruments; Microstructure; Nickel Alloys; Precipitates; Transmission Electron Microscopy

20100020286 National Oceanic and Atmospheric Administration, Oxford, MD USA
ROVs in a Bucket: Contagious, Experiential Learning by Building Inexpensive, Underwater Robots
Levin, Douglas R.; Trono, Krista; Arrasate, Christine; 2007; 8 pp.; In English
Report No.(s): AD-A519491; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Remotely Operated Vehicle (ROV) can be an underwater robot. A simple ROV has been developed that can be built by grade-school children using off-the-shelf and off-the-Internet parts. PVC pipe is used for the frame, bilge pump motors for thrust, and speaker wire transfers power and control information from the switch box to the robot. Soldering is not required. Once constructed, these ROVs are safely powered by 12v car batteries and are small enough to be run inside a 30-gallon trash can or small pool. Parts for the ROV kit can be purchased for under $125 (sans camera and lights). A detailed ROV build manual is available from doug.levin\@noaa.gov. The program is an effective delivery tool that links marine science with a host of other, related disciplines.
DTIC
Low Cost; Remote Control; Robots; Underwater Vehicles

20100020307 Army Research Development and Engineering Command, Warren, MI USA
Dual Use Material Developers Panel
Brogan, Michael; Asada, Michael; March 18, 2010; 7 pp.; In English; 2010 Ground Robotics Capabilities Conference and Exhibition, 16-18 Mar. 2010, Miami FL, USA; Original contains color illustrations
Report No.(s): AD-A519675; RDECOM-TARDEC-20609RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

These briefing charts discuss ground robots and warfare. Much attention is given to joint robotic repair and fielding and dual use technologies. The Joint Robotics Repair and Fielding (JRRF) activity was established in mid 2004 to provide maintenance, supply and training for all Joint Service Non-Standard Equipment Robotic systems. Its mission is to provide in-Theater Support for Joint Service Theater Provided Equipment (TPE) Ground Robots. Serve as Single Belly Button on-stop shop for fielding, sustainment, training, assessment and total asset accountability for all robotic systems, including Iraq and Afghanistan.
DTIC
Robotics; Technology Assessment

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20100018528 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Twente Univ., Netherlands
Unconditionally Stable Integration of Maxwell's Equations
Verwer, J. G.; Botchev, M. A.; September 2008; 26 pp.; In English
Report No.(s): PB2010-107587; MAS-R0806; Copyright; Avail.: National Technical Information Service (NTIS)

Numerical integration of Maxwell's equations is often based on explicit methods accepting a stability step size restriction. In literature evidence is given that there is also a need for unconditionally stable methods, as exemplified by the successful alternating direction implicit-finite difference time domain scheme. In this paper we discuss unconditionally stable integration for a general semi-discrete Maxwell system allowing non-Cartesian space grids as encountered in finite element discretizations. Such grids exclude the alternating direction implicit approach. Particular attention is given to the second-order trapezoidal rule implemented with preconditioned conjugate gradient iteration and to second-order exponential integration using Krylov subspace iteration for evaluating the arising phi-functions. A three-space dimensional test problem is used for numerical assessment and comparison with an economical second-order implicit-explicit integrator. We further pay attention to the Chebyshev series expansion for computing the exponential operator for skew-symmetric matrices.
NTIS
Maxwell Equation; Numerical Integration; Alternating Direction Implicit Methods; Integral Calculus

20100018675 Monopole Research, Thousand Oaks, CA USA
Hearing Protection for High-Noise Environments. Atachment 1: Development of Elastoacoustic Integral-Equation Solver: Surface and Volumetric Integral Equations
Nov 30, 2009; 81 pp.; In English
Contract(s)/Grant(s): FA9550-08-C-0006
Report No.(s): AD-A517839; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517839

Following an introductory section, Section 2 provides a complete account of the integral-equation formulations as they are being implemented in our solver for elasticity problems. Section 3 presents a discussion of several equivalent forms of the Lame differential equation in elasticity, including its first-order representation as a set of coupled equations for the displacement and the stress tensor. In addition, we derive forms of the differential equations with separated terms describing solution in the background medium (such as air) and interaction terms describing effects of the deviations of the medium properties from those of the background material. In Section 4, we discuss the Green functions associated with the Lame equation for the displacement field. In particular, we obtain a form of the Green function that explicitly exhibits a nonsingular behavior of its dyadic-derivative part, which facilitates discretization of the resulting integral equations. In the following Sections, 5 and 6, we are concerned with integral-equation formulations in elasticity in three cases: (1) purely surface (boundary-element) equations, (2) purely volumetric (Lippmann-Schwinger, or L-S) equations, and (3) a coupled system of volume and surface equations. The last of these is a novel approach we developed, mostly to be able to efficiently model

geometry components -- in our case, the middle and inner ear -- characterized by small sizes and intricate surfaces, and embedded in a larger volume of an inhomogeneous material.
DTIC
Acoustic Scattering; Coding; Differential Equations; Ear Protectors; Elastic Properties; Elastic Waves; Integral Equations; Mathematical Models

20100018690 Navy Center for Applied Research in Artificial Intelligence, Washington, DC USA
Computational Modeling of Cognitive Processes in Plan Authoring
Murdock, J W; Aha, David W; Jan 17, 2002; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517887; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517887

SUMMARY: Intelligent system collaborates with a human user; the system provides recommendations during plan authoring. * Cognitive model is used to infer what the user wants to do and how the user wants to do it. * User's cognitive model is composed of Tasks, Methods, and Knowledge (TMK). * Proposed tool recommends actions for doing what the user wants in the way that the user wants to do it.
DTIC
Cognition; Planning

20100018694 Monopole Research, Thousand Oaks, CA USA
Hearing Protection for High-Noise Environments. Attachment 4: Parallelization of the Acoustic Integral-Equation Solver and Example Applications
Nov 30, 2009; 42 pp.; In English
Contract(s)/Grant(s): FA9550-08-C-0006
Report No.(s): AD-A517903; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517903

We have recently developed a fast iterative volumetric integral-equation solver for acoustic scattering and propagation problems involving inhomogeneous media. The solver incorporates a Fast Fourier Transform (FFT)-based matrix compression technique and the corresponding fast matrix-vector multiplication algorithm. The method consists, essentially, of the method-of-moments (MoM) computation of the near-field interactions involving physical sources and fields, and evaluation of the far-field by means of the FFTs operating on equivalent source and field distributions defined on nodes of a regular Cartesian grid. The FFT-based matrix compression is particularly well suited to volumetric discretization (with a fairly uniform discretization) and to sub-wavelength problems, i.e., spatial resolution scale much smaller than the wavelength. Both of these features are characteristic of realistic anatomical models and propagation problems in the biological applications we are considering.
DTIC
Acoustic Scattering; Anatomy; Distributed Processing; Ear Protectors; Fast Fourier Transformations; Integral Equations; Parallel Processing (Computers)

20100018704 Naval Postgraduate School, Monterey, CA USA
Precision Guided Airdrop for Vertical Replenishment of Naval Vessels
Hewgley, Charles W; Yakimenko, Oleg A; May 7, 2009; 14 pp.; In English
Report No.(s): AD-A517932; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517932

This paper addresses the investigation into the feasibility of the use of precision guided airdrop as a means to deliver cargo to naval vessels at sea. In this context, precision guided airdrop means delivering unmanned cargo packages that, once dropped from an aircraft at high altitude, have the capability to guide themselves to a precise landing point by con- trolling an aerodynamic decelerator (parafoil or parachute) to which the cargo package is attached. The paper describes the problem of replenishment of naval vessels at sea and describes the benefits that the application of precision airdrop might provide. Improved accuracy of aerial delivery systems is the major focus of analysis, and how the application of model predictive control has potential to achieve the necessary improvements in accuracy that would make shipboard landings possible. A simple example is developed of a model predictive control algorithm adapted to track a target landing area that is moving with

constant velocity. Additional techniques are also surveyed, as well as other potential applications of precision airdrop to maritime operations.
DTIC
Air Drop Operations; Airdrops; Precision; Replenishment

20100018778 National Standard Time and Frequency Lab., Taoyuan, Taiwan, Province of China
Proficiency Testing Activities of Frequency Calibration Laboratories in Taiwan, 2009
Lin, Huang-Tien; Chang, Po-Cheng; Wang, Jia-Lun; Liao, Chia-Shu; Nov 2009; 7 pp.; In English
Report No.(s): AD-A518094; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518094

In order to meet the requirements of ISO 17025 and the demand of TAF (Taiwan Accreditation Foundation) for calibration inter-laboratory comparisons, the National Time and Frequency Standard Laboratory (TL) [1], playing the role of coordinating lab, has periodically organized the proficiency testing activities to provide opportunities for capability comparisons of domestic frequency calibration laboratories. The latest two activities were performed in 2006 [2] and this year (2009). The Device under Test (DUT), together with TL's calibration system, was transferred to each participating laboratory according to a predetermined schedule. The DUT was measured by the participating lab's and TL's calibration systems simultaneously. The measured results from both systems were then analyzed and compared. There were 12 and 15 participating labs joined the activities performed in 2006 and 2009, respectively. All of them were TAF-accredited laboratories. As usual, the En value was used to evaluate a lab's capability of calibrating equipment within its accredited measurement uncertainty. In these two activities, the absolute En values of all labs were smaller than 1, which means their calibration ability was completely qualified. In this paper, the related details of these two activity and the result comparisons between activities in 2006 and 2009 are illustrated.
DTIC
Abilities; Calibrating; Evaluation; Frequencies; Frequency Standards; System Effectiveness; Taiwan; Time Measurement

20100018819 Naval Research Lab., Washington, DC USA
Impact of Uncertainty on Terror Forecasting
Schmidt, G S; Goffeney, J; Willis, R; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518223; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518223

Intelligence analysts and military planners need accurate forecasting techniques for predicting future terror events. Terror forecasts must consider historical events, up-to-date geospatial features, terrorist behavior, and uncertainty and error in the input measurements and propagation of data. We describe our forecasting technique and investigation of the impact of uncertainty and error on predicting future terror events.
DTIC
Forecasting; Terrorism

20100018820 Naval Research Lab., Washington, DC USA
Computational Materials Theory: Optimizing the Use of the Electromagnetic Spectrum
Pederson, M R; Mehl, M J; Boyer, L L; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518224; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518224

The ability to computationally predict how materials respond to incident radiation is of immeasurable importance to practically every DoD and civilian technology. While applications are too numerous to list, they include spectroscopic remote sensing, infrared night vision technologies, X-ray analysis, magneto-resonance imaging, photovoltaic light harvesting, information transmission and storage, and quantum control of molecules. In principle, the ability to theoretically predict how molecules and materials respond to incident radiation has been in hand since the early days of quantum theory of materials. While more improvements are required and are on their way, today, due to long-term support of the Office of Naval Research and significant contributions from Navy researchers, scientists are able to computationally predict how materials interact with X rays, optical radiation, infrared and terahertz radiation, and extremely low frequency radiation such as that due to microwaves and static fields. Work discussed here pertains to the computational prediction of a material's ability to respond to radiation in the latter four frequency ranges.
DTIC
Electromagnetic Spectra; Optimization

20100018887 SpectraTime, Neuchatel, Switzerland

An Anomaly Clock Detection Algorithm for a Robust Clock Ensemble

Wang, Qinghua; Rochat, Pascal; Nov 2009; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518324; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Anomaly Clock Detection Algorithm is intended to facilitate a monitoring system to better manage a clock system, insuring continuity of operations and limiting the expected degradation of performance due to contingencies and anomalies. A novel ensemble of five Rubidium Atomic Frequency Standards (RAFS) is proposed onboard the future Global Navigation Satellite System. All clocks are in phase and on frequency all the time with advantages of relatively simple, robust, fully redundant, and improved performance. It allows reliable anomaly detection and smooth switch-over of master and redundant clocks using the same clock model. The algorithm is designed on the basis of the clock output phase/frequency measurements to detect the 'Feared Events' such as phase jump, frequency jump, and frequency instability, which affect various atomic clocks. The proper detection strategy has been determined in view of the detection capability and computation efforts. Algorithm parameters, such as the sliding window width as a function of the time constant, and the minimum detectable levels have been optimized and verified as the trade-off of the detection capability, response speed, and detection confidence. The verification results under numerous test cases in the presence of anomalies that occurred in various RAFS, as well as the clock ensemble, are demonstrated.

DTIC

Algorithms; Anomalies; Atomic Clocks; Clocks; Detection

20100018961 California Univ., Berkeley, CA USA

A Scratchpad Memory Allocation Scheme for Dataflow Models

Bandyopadhyay, Shamil; Feng, Thomas H; Patel, Hiren D; Lee, Edward A; Aug 25, 2008; 42 pp.; In English

Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312

Report No.(s): AD-A518569; UCB/EECS-2008-104; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Scratchpad memories are alternatives to caches in real-time embedded processors. They provide better timing predictability and lower energy consumption. However, program code and data must be explicitly moved in the memory hierarchy. Current practice either leaves it up to the programmer to manually manage the memory or to use low-level compiler techniques to create an allocation schedule. In this paper, we show how to leverage the structure and semantics of a dataflow model to make optimal use of scratchpads. We assume the heterochronous dataflow model of computation (or its special cases). To show feasibility of the approach, we formulate an ILP problem to minimize the memory access times. We provide performance comparisons between our memory allocation scheme and caches with LRU replacement policy.

DTIC

Compilers; Data Processing

20100018962 California Univ., Berkeley, CA USA

A Timing Requirements-Aware Scratchpad Memory Allocation Scheme for a Precision Timed Architecture

Patel, Hiren D; Lickly, Ben; Burgers, Bas; Lee, Edward A; Sep 12, 2008; 18 pp.; In English

Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312

Report No.(s): AD-A518573; UCB/EECS-2008-115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The precision timed architecture presents a real-time embedded processor with instruction-set extensions that provide precise timing control via timing instructions to the programmer. Programmers not only describe their functionality using C, but they can also prescribe timing requirements in the program. We target this architecture and present a static scratchpad memory allocation scheme that greedily attempts to meet these timing requirements. Our objective is to schedule minimum number of instructions and minimize data allocation to the scratchpads such that timing requirements in the program are met. Once the timing requirements are satisfied, the remainder of the scratchpad memory can be used to optimize some other metric desired by the programmer. As an example, we minimize the frequency of main memory accesses in the program. This work presents the following: 1) high-level timing constructs for C that synthesize to timing instructions and 2) a greedy iterative instruction and data scratchpad memory allocation scheme that attempts to first meet the specified timing requirements.

DTIC

Architecture (Computers); C (Programming Language); Real Time Operation

20100018967 Naval Academy, Annapolis, MD USA

Enumerative Algebraic Geometry of Conics

Bachelor, Andrew; Ksir, Amy; Traves, Will; Oct 2008; 29 pp.; In English

Contract(s)/Grant(s): N00014-05-R-20153

Report No.(s): AD-A518580; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In 1848 Jakob Steiner, professor of geometry at the University of Berlin, posed the following problem [19]: Given five conics in the plane, are there any conics that are tangent to all five? If so, how many are there? Problems that ask for the number of geometric objects with given properties are known as enumerative problems in algebraic geometry. The tools developed to solve these problems have been used in many other situations and reveal deep and beautiful geometric phenomena. In this expository paper, we describe the solutions to several enumerative problems involving conics, including Steiner's problem. The results and techniques presented here are not new; rather, we use these problems to introduce and demonstrate several of the key ideas and tools of algebraic geometry. The problems we discuss are the following: Given p points, l lines, and c conics in the plane, how many conics are there that contain the given points, are tangent to the given lines, and are tangent to the given conics? It is not even clear a priori that these questions are well-posed. The answers may depend on which points, lines, and conics we are given. Nineteenth and twentieth century geometers struggled to make sense of these questions, to show that with the proper interpretation they admit clean answers, and to put the subject of enumerative algebraic geometry on a firm mathematical foundation. Indeed, Hilbert made this endeavor the subject of his fifteenth challenge problem.

DTIC

Algebra; Combinatorial Analysis; Conics

20100018989 Naval Postgraduate School, Monterey, CA USA

An Analysis of Algorithms for Solving Discrete Logarithms in Fixed Groups

Mihalcik, Joseph; Mar 2010; 70 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518636; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Internet protocols such as Secure Shell and Internet Protocol Security rely on the assumption that finding discrete logarithms is hard. The protocols specify fixed groups for Diffie-Hellman key exchange that must be supported. Although the protocols allow flexibility in the choice of group, it is highly likely that the specific groups required by the standards will be used in most cases. There are security implications to using a fixed group, because solving any discrete logarithm within a group is comparatively easier after a group-specific precomputation has been completed. In this work, we more accurately model real-world cryptographic applications with fixed groups. We use an analysis of algorithms to place an upper bound on the complexity of solving discrete logarithms given a group-specific precomputation.

DTIC

Algorithms; Internets; Logarithms; Protocol (Computers)

20100018997 Naval Postgraduate School, Monterey, CA USA

Classification of Digital Modulation Schemes Using Linear and Nonlinear Classifiers

Geisinger, Nathan P; Mar 2010; 240 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518653; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The potential benefits of automated detection of digital modulation types have made it a continuing topic of research for many years. Commercial systems could be made more interoperable and military sensors could send demodulated products for analysis, to name just two. Noisy channels and multipath fading environments continue to make this a challenging problem. This thesis applies classification algorithms that have been used in other applications. Nine different digital modulation schemes are considered. The criteria for selecting higher-ordered moments and cumulants as features for discrimination are discussed. An overview of the classification algorithms considered is provided, as well as the statistical models for noisy channels. Results show that the scheme proposed here works well in AWGN channels and in moderate fading conditions.

DTIC

Classifications; Classifiers; Digital Systems; Linear Systems; Modulation; Nonlinear Systems; Nonlinearity

20100019004 Naval Research Lab., Washington, DC USA

A Note on Determining the Electron Distribution Function from RF Impedance Probe Measurements

Walker, David N; Fernsler, Richard F; Blackwell, David D; Amatucci, William E; Feb 17, 2010; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-67-9872-00

Report No.(s): AD-A518666; NRL/MR/6750-10-9237; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have demonstrated in earlier work the usefulness of a network analyzer in plasma diagnostics using spherical probes in the thin sheath limit. The rf signal applied to the probe by the network analyzer is small in magnitude compared to probe bias voltages and the instrument returns both real and imaginary parts of the complex plasma impedance as a function of frequency for given bias voltages. This information can be used to determine sheath resistance, sheath density profiles, and a technique for measuring electron temperature.

DTIC

Distribution Functions; Electron Density (Concentration); Electron Distribution; Impedance; Impedance Probes; Radio Frequencies

20100019005 Naval Research Lab., Bay Saint Louis, MS USA

Validation Test Report for the ADvanced CIRCulation Model (ADCIRC) v45.11

Blain, Cheryl A; Linzell, Robert S; Chu, Philip; Massey, Chris; Feb 26, 2010; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518667; NRL/MR/7320-10-9205; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Validation Test Report for the Advanced CIRCulation Model, ADCIRC, v45.11 addresses the prediction of barotropic 2D and 3D currents, water levels and inundation. Validation efforts address 1) the wetting and drying capability, 2) the prediction of surge, inundation and surge-induced currents, 3) the prediction of two- and three-dimensional currents and water levels in a bay, and 4) the prediction of three-dimensional tidal currents in the wake of an island. Lastly, a simulated real-time exercise with the model is conducted during the international sea trial, MREA07, and is used to evaluate the developed enabling software as well as the prediction of 2D barotropic currents. Generally, model predictions of evaluated products are reasonably accurate and realistic for truly barotropic applications. More work is needed to better assess the impact of boundary condition specification on predictive capability and to determine the model sensitivity to the 3D turbulence closure formulation and parameter selection.

DTIC

Computerized Simulation; Delaware Bay (US); Evaluation; Marine Environments; System Effectiveness; Tides

20100019007 Naval Postgraduate School, Monterey, CA USA

Correlating Temporal Rules to Time-Series Data With Rule-Based Intuition

Kearton, Kristian; Mar 2010; 82 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Analysts are frequently confronted with time-series data. A simple form is magnitude (or count) and time frame, whether the data is number of e-mails sent, number of cell phones called, purchases made by volume or cost, or a variety of other time-derived data. Studying the temporal dimension of data allows analysts more opportunities to find relational ties and trends in data, classify or group like activity, and even help narrow the search space of massively complex and large datasets. This thesis presents a new approach called the Rule Based Intuition (RBI) system that can evaluate time-series data by finding the best fitting rule, from a repository of known rules, to quickly infer information about the data. This approach is most applicable for analysts viewing large sets of data who wish to classify or correlate data from users' temporal activity.

DTIC

Correlation; Time Series Analysis

20100019008 Naval Research Lab., Washington, DC USA

Comments on Optical Fiber Communication Channel Capacity Results of Song, Mahajan, Mahadevan, and Morris

Moskowitz, Ira S; Kang, Daniel D; Mar 10, 2010; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518673; NRL/MR/5540-10-9248; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on our numerical results concerning the capacity of certain binary symmetric channels with asymmetric

erasures. Plots of our numerical capacity solutions are offered in contrast to some of the existing literature.
DTIC
Asymmetry; Channel Capacity; Channels (Data Transmission); Communication Networks; Fiber Optics; Numerical Analysis; Optical Fibers; Transmission Lines

20100019017 Clemson Univ., SC USA
Air/Water Flow in Porous Media: A Comparison of Accurate and Efficient Numerical Methods
Jenkins, Eleanor W; Dec 7, 2009; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-05-1-0380
Report No.(s): AD-A518697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research funded under this grant focused on solution algorithms for porous media flow models. We sought to improve both spatial and temporal computational methods for a range of problems associated with groundwater and surface water flows. Groundwater flow problems can be difficult to resolve for several reasons. The governing equations are nonlinear, as the permeability coefficient for the Darcy velocity depends on the saturation level. This dependence on saturation also means that the governing equation can change type, from parabolic to hyperbolic, or vice versa, as an infiltration front moves through the domain. In addition, the governing equation can change type as fluid flows from one material type to another (e.g., from sand to clay). In all cases, the challenges are both on the temporal and spatial domains.
DTIC
Fluid Flow; Ground Water; Mathematical Models; Numerical Analysis; Porosity; Porous Materials; Surface Water; Water Flow

20100019019 Applied Computational Electromagnetics Society, USA
Applied Computational Electromagnetics Society Journal, Part 2. Volume 25, Number 1
Barmada, Sami; Jan 2010; 107 pp.; In English
Report No.(s): AD-A518707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The finite-difference time-domain (FDTD) method has established itself among the most popular methods for the numerical solution of Maxwell equations. Reasons for its popularity include its versatility, matrix-free characteristic, ease for parallelization, and low computational complexity. In recent years, the finite-element time-domain (FETD) has also become another very popular algorithm for solving time-domain Maxwell equations due to its geometrical flexibility and the steady growth in hardware computing power. In this review, we succinctly recollect some of the milestones in the development of FDTD and FETD over the last 25 years, and briefly discuss some challenges for the future development of these two algorithms.
DTIC
Computational Electromagnetics; Finite Difference Theory; Finite Difference Time Domain Method; Finite Element Method

20100019035 Naval Postgraduate School, Monterey, CA USA
Surface Wave Processes on the Continental Shelf and Beach
Herbers, Thomas H; Janssen, Tim T; Guza, Robert T; O'Reilly, William C; Jan 2007; 10 pp.; In English
Contract(s)/Grant(s): N00014-07-WR-2-0142; N00014-07-WR-2-0227
Report No.(s): AD-A518769; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Wind waves and swell dominate the hydrodynamic and sediment transport processes on many continental shelves and beaches, affect underwater acoustics, and play an important role in remote sensing applications. Wave prediction in coastal environments is a challenging task because waves are affected by many processes, including scattering by seafloor topography, strong nonlinear interactions, wave breaking, and friction in the bottom boundary layer. Several of these processes are poorly understood and existing wave prediction models rely on parameterizations and empirical validation to represent them. The long term goals of this research are to obtain a better understanding of the physical processes that affect ocean surface waves in the coastal environment and develop accurate wave prediction models.
DTIC
Beaches; Canyons; Continental Shelves; Mathematical Models; Ocean Bottom; Surface Waves; Topography

20100019052 California Univ., Berkeley, CA USA

Machine Learning in the Presence of an Adversary: Attacking and Defending the SpamBayes Spam Filter

Saini, Udam; May 20, 2008; 55 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0244; FA9550-07-1-0501

Report No.(s): AD-A518825; UCB/EECS-2008-62; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Machine learning techniques are often used for decision making in security critical applications such as intrusion detection and spam filtering. However, much of the security analysis surrounding learning algorithms is theoretical. This thesis provides a practical evaluation of the algorithms used by SpamBayes, a statistical spam filter, to determine its ability to correctly distinguish spam email for normal email when learning in the presence of an adversary. This thesis presents both attacks against SpamBayes and defenses against these attacks. The attacks are able to subvert the spam filter by both causing a high percentage of false positives and false negatives. With only a 100 attack emails, out of an initial training corpus of 10,000, the spam filter's performance is sufficiently degraded to either cause a denial of service attack or successfully allow spam emails to bypass the filter. The defenses shown in this thesis are able to work against the attacks developed against SpamBayes and are sufficiently generic to be easily extended into other statistical machine learning algorithms.

DTIC

Algorithms; Artificial Intelligence; Decision Making; Machine Learning; Message Processing

20100019201 I M Systems Group, Charleston, SC USA; Perot Systems Corp., Charleston, SC, USA; National Oceanic and Atmospheric Administration, Charleston, SC, USA

Time-Series Data Exchange Using the Geography Markup Language

Martin, Daniel R; Ulmer, John; Boyd, James; Jan. 2007; 8 pp.; In English; MTS/IEEE Oceans 2007 Conference, 29 Sep. - 4 Oct. 2007, Vancouver, Canada; Original contains color illustrations

Report No.(s): AD-A518472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Geography Markup Language (GML) is a well known XML dialect that offers the ocean observing community a robust and standards based encoding for data exchange. Adaptations of GML are evolving to meet the needs and uses of different communities. Understanding how to use GML to model and exchange observatory time-series data will be critical to building a national data resource from the federation of observatories that form the Integrated Ocean Observing System (IOOS). The NOAA Coastal Services Center conducted an experiment with several nonfederal partners using the GML Simple Features Profile and the Web Feature Service (WFS). An application schema, a content model, a GML dictionary, and a special purpose WFS were used to exchange data between an observatory and a data-assembly center relational database.

DTIC

Document Markup Languages; Geography; Time Series Analysis

20100019212 Naval Research Lab., Bay Saint Louis, MS USA

Producing Surf Forecasting Parameters from Delft3D

Hsu, Y L; Edwards, Kacey L; Allard, Richard A; Feb. 24, 2010; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518669; NRL/MR/7320-10-9213; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The software for generating surf forecasting parameters from Delft3D output is upgraded to handle cases in curvilinear grid and spherical coordinates. Standard NAVO surf output such as the 6-panel surf plot is now generated automatically. Major code improvements are made to eliminate any manual input or change to produce operational output.

DTIC

Computer Programs; Computerized Simulation; Forecasting; Software Development Tools

20100019629 Battelle Marine Sciences Lab., Sequim, WA USA

ONR Tidal Flats DRI: Planning Joint Modeling and Field Exercises

Hibler, Lyle; Maxwell, Adam; Jan 2007; 7 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0694

Report No.(s): AD-A518774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518774

The ultimate goal of this work is to assist in the development of science plan for gaining a state-of-the-art understanding of macro-tidal, muddy estuarine/coastal environments through field experiments and modeling efforts. This is a challenging environment for a modeling framework, due to complexity of both the tidal currents and sediment erosion and deposition patterns. The morphologic modeling perspective has been our focus. The objective of the first phase of this work is the

planning and development of joint modeling and field exercises, through attendance at and participation in the workshops hosted by the Office of Naval Research. Later phases will result in the potential development of a model of selected site(s), with validation and calibration facilitated by field program based on both in-situ and remotely sensed measurements. Battelle's specific participation was geared toward the circulation, transport and geomorphological modeling of these environments and incorporation of this perspective into the overall science plan. The use of models to help address the relative importance of tidal and river discharge to geomorphology has been identified as a key issue.
DTIC
Beaches; Computerized Simulation; Field Tests; Mathematical Models; Tidal Flats; Tides

20100019634 California Univ., Los Angeles, CA USA
Convex Formulation and Exact Global Solutions for Multi-phase Piecewise Constant Mumford-Shah Image Segmentation
Brown, Ethan S; Chan, Tony F; Bresson, Xavier; Aug 20, 2009; 28 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0071
Report No.(s): AD-A518796; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518796

Most variational models for multi-phase image segmentation are non-convex and possess multiple local minima, which makes solving for a global solution an extremely difficult task. In this work, we provide a method for computing a global solution for the (non-convex) multi-phase piecewise constant Mumford-Shah (spatially continuous Potts) image segmentation problem. Our approach is based on using a specific representation of the problem due to Lie et al. [27]. We then rewrite this representation using the dual formulation for total variation so that a variational convexification technique due to Pock et al. [30] may be employed. Unlike some recent methods in this direction, our method can guarantee that a global solution is obtained. We believe our method to be the first in the literature that can make this claim. Once we have the convex optimization problem, we give an algorithm to compute a global solution. We demonstrate our algorithm on several multi-phase image segmentation examples, including a medical imaging application.
DTIC
Algorithms; Convexity; Image Processing; Imaging Techniques

20100019758 California Univ., Berkeley, CA USA
Model Engineering using Multimodeling
Brooks, Christopher; Cheng, Chihhong P; Feng, Thomas H; Lee, Edward A; von Hanxleden, Reinhard; Apr 16, 2008; 19 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312
Report No.(s): AD-A519166; UCB/EECS-2008-39; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519166

We study the simultaneous use of multiple modeling techniques in the design of embedded systems. We begin with a pre-existing Statecharts model of a simple case study, a traffic light for a pedestrian crossing. This model combines two distinct models of computation (MoCs), finite state machines (FSMs) and synchronous/reactive (SR). We add an additional MoC to the mix, a discrete-event (DE) model of the environment in which the traffic light operates, including a simple fault model. We construct a second model of a hardware deployment. This exercise reveals hidden assumptions in the original model about implementation that require refactoring to get a distributed deployment model. We show that the portions of the models defining the control logic of the lights can be shared between the functional and deployment models using actor-oriented classes. This eases maintenance of the models. Finally, we show that models used for verification are abstractions of the functional models that can be synthesized from the other models, suggesting practical design-for-verification techniques. The result is that this simple example uses three distinct models of the system (functional, deployment, verification), two of which hierarchically combine distinct modeling techniques (DE, SR, FSM).
DTIC
Engineering; Models

20100019762 California Univ., Berkeley, CA USA

Multimodeling: A Preliminary Case Study

Brooks, Christopher; Feng, Thomas H; Lee, Edward A; van Hanxleden, Reinhard; Jan 17, 2008; 16 pp.; In English

Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312

Report No.(s): AD-A519171; UCB/EECS-2008-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519171

We take a pre-existing Statecharts model of a simple traffic light controller and re-implement it in Ptolemy II. This exercise reveals that Statecharts can be usefully conceptualized as a hierarchical combination of two distinct models of computation (MoCs), finite state machines (FSMs) and synchronous/reactive (SR). Once conceptualized this way, we can add additional MoCs to the mix. We illustrate this by adding a discrete-event (DE) model of the environment in which the traffic light operates. We then construct a second model of a deployment of the system on two microcontrollers communicating wirelessly, showing that we can effectively leverage both DE and an extension in Ptolemy II that supports modeling of wireless communication networks. This exercise reveals that even though the original model was intended to be a purely functional model, it in fact imposes constraints on the implementation. The model had to be refactored to get a distributed deployment model. Finally, we show that the portions of the models defining the control logic of the lights can be shared between the functional and deployment models using actor-oriented classes. This eases maintenance of the models.

DTIC

Communication Networks; Models; Traffic; Wireless Communication

20100019888 Scripps Institution of Oceanography, La Jolla, CA USA

Finite Difference Modeling of Infrasound Propagation to Local and Regional Distances

de Groot-Hedlin, Catherine; Sep 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W9113M-06-1-0003

Report No.(s): AD-A519378; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The finite difference (FD) method yields the solution to a discretized version of the full acoustic wave equation for arbitrarily complex media. It is a full spectrum approach and is thus reliable at all angles of propagation, including backscatter. This offers an advantage over other standard propagation methods in wide use, as it allows for accurate computation of acoustic energy levels in the case where significant scattering can occur near the source, such as may happen for an explosion near the surface, or underground. This fits in with nuclear monitoring goals, in that it allows for an improved understanding of the generation and propagation of infrasound energy from arbitrary sources, including underground and near-surface explosions. Two types of FD methods of solving the acoustic wave equation are presented in this paper. The first is a finite difference frequency domain (FDFD) method, applied in cylindrical coordinates to simulate the effects of a point source in an azimuthally symmetric medium. The second is a finite difference time domain (FDTD) approach including the effects of both gravity and wind, applied in two-dimensional Cartesian coordinates. In this paper equations are developed for the FDTD approach where both wind and gravity effects are considered. It is shown that the FD approach can be used to solve for sound intensities in arbitrarily complex models that may include high material contrasts and arbitrary topography. In this paper, results of FDTD and FDFD approaches are compared for the case of a shallow underground source, for a boundary with significant topography. The effects of wind and gravity on the solution are examined.

DTIC

Backscattering; Distance; Finite Difference Theory; Frequencies; Infrasonic Frequencies; Mathematical Models; Sound Waves; Underground Explosions

20100019889 Arnold Engineering Development Center, Arnold AFS, TN USA

Comparison of Subpixel Phase Correlation Methods for Image Registration

Reed, R A; Apr 2010; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-10909

Report No.(s): AD-A519383; AEDC-TR-10-S-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The popular phase correlation method (PCM) for image registration has been extended to subpixel accuracy by several alternative algorithms, each claiming accuracies on the order of 0.02 - 0.03 pixels for 256 x 256 images. However, the performance reported in the literature is sometimes based upon idealized images or upon just a few selected images. This leaves users in doubt as to which algorithm is truly superior. This work compares three subpixel PCM algorithms using a common test set of realistic images derived from satellite imagery. Of the three algorithms investigated in this work, the one of Guizar et al. (conceptually the simplest) consistently performed best.

DTIC

Algorithms; Correlation; Image Processing; Pattern Registration

20100019896 Nanyang Technological Univ., Nanyang, Singapore

Intelligent Scene Analysis and Recognition

Ma, Kai-Kuang; Mar 30, 2010; 44 pp.; In English

Report No.(s): AD-A519403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Knowing the name of the location and relative position towards the landmarks not only facilitates the end-user's navigation, but also provides the possibility to offer follow-up geographical services. Visual Location Recognition and Registration (VLRR) is addressed in this report, which refers to the problem of predicting the name and relative position of the location only using the captured query image. This problem is almost ill-posed, because on one hand, there is no formal definition of what constitutes a location and it is still not clear which are the location's properties that helps us to perform the recognition. On the other hand, in order to determine the relative position of the end-user, image registration of large viewpoint variation is required, which itself severely suffers from the well-known matching ambiguity. To solve the first difficulty, Bag-of-Features (BoF) model based on visual codebook is used, where the codebook is obtained by performing an unsupervised clustering on local image features extracted from the training images. Consequently, each location and query image can be efficiently represented by the corresponding histograms of the appearance of visual words in the codebook. Finally a classifier is designed to make the final decision based on the similarity of those histograms via a supervised learning. However, this BoF model lacks of being aware that different visual words actually provide different discrimination power in the sequential location classification. Therefore, a simple and novel weighting scheme, called Visual Words Aggregation Weighting (VWAW) is proposed and we assume those visual words which are cluster centers of highly aggregated local image features while with less neighboring words to be more important than others. These two assumptions are reasonable in the sense that highly aggregated cluster center usually has smaller clustering error and the visual word with less neighborhood is more discriminant and robust.

DTIC

Discriminant Analysis (Statistics); Histograms; Position (Location); Scene Analysis; Words (Language)

20100019917 Columbia Univ., New York, NY USA

A Survey of Insider Attack Detection Research

Salem, Malek B; Hershkop, Shlomo; Stolfo, Salvatore J; Aug 25, 2008; 23 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0151

Report No.(s): AD-A519455; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper surveys proposed solutions for the problem of insider attack detection appearing in the computer security research literature. We distinguish between masqueraders and traitors as two distinct cases of insider attack. After describing the challenges of this problem and highlighting current approaches and techniques pursued by the research community for insider attack detection, we suggest directions for future research.

DTIC

Computer Information Security; Surveys

20100020003 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Low Probability of Intercept Waveforms via Intersymbol Dither Performance Under Multiple Conditions

Keen, Jonathan K; Mar 2009; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519648; AFIT/GE/ENG/09-32; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The digital fingerprint (DF) creates a unique ID for any FPGA which cannot be tampered with or reproduced. The two most important factors in determining the success of a DF ID are its distinguishability and it stability. An ID must be robust enough so that it can distinguish a large number of chips and stable enough that it won't change when subjected to environmental changes. The DF methodology was automated. Then for distinguishability, it was tested on 60 circuits under ideal conditions as well as stressed by subjecting it to different supply voltages, a variety of different input values and different types of combinational circuits. Of these, it was concluded that input value and the type of combinational circuit used had the greatest influence on DF distinguishability. For stability, 60 digital circuits were stressed at different operating temperatures, supply voltages and input values. Here, it was determined that input value and operating temperature had the greatest impact on DF ID stability. These tests have given a greater understanding of the DF circuit and gives a guideline for creating future DF circuits with high distinguishability and stability.

DTIC

Digital Systems; Dithers; Probability Theory; Waveforms

20100020029 Rice Univ., Houston, TX USA

A Theoretical Analysis of Joint Manifolds

Davenport, Mark A; Hegde, Chinmay; Duarte, Marco F; Baraniuk, Richard G; Jan 7, 2009; 26 pp.; In English

Contract(s)/Grant(s): W911NF-07-1-0185; N66001-08-2065

Report No.(s): AD-A519729; TR-EE-0901; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The emergence of low-cost sensor architectures for diverse modalities has made it possible to deploy sensor arrays that capture a single event from a large number of vantage points and using multiple modalities. In many scenarios, these sensors acquire very high-dimensional data such as audio signals, images, and video. To cope with such high-dimensional data, we typically rely on low-dimensional models. Manifold models provide a particularly powerful model that captures the structure of high-dimensional data when it is governed by a low-dimensional set of parameters. However, these models do not typically take into account dependencies among multiple sensors. We thus propose a new joint manifold framework for data ensembles that exploits such dependencies. We show that simple algorithms can exploit the joint manifold structure to improve their performance on standard signal processing applications. Additionally, recent results concerning dimensionality reduction for manifolds enable us to formulate a network-scalable data compression scheme that uses random projections of the sensed data. This scheme efficiently fuses the data from all sensors through the addition of such projections, regardless of the data modalities and dimensions.

DTIC

Algorithms; Architecture (Computers); Signal Processing; Signal Transmission; Sound Waves

20100020280 Air Force Research Lab., Wright-Patterson AFB, OH USA; Texas Univ., San Antonio, TX, USA

Optimal Allocation of Testing Resources for Statistical Simulations (PREPRINT)

Golden, Patrick; Quintana, Carolina; Singh, Gulshan; Millwater, Harry R.; April 2010; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4347; 62102F

Report No.(s): AD-A519645; AFRL-RX-WP-TP-2010-4163; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is well known that statistical estimates from simulation, e.g., computation of mean and standard deviation, often involve significant uncertainty due to uncertainty in the input parameters. The uncertainty in the output results can be reduced with additional data on the inputs, e.g., additional experiments. An optimization methodology is proposed and implemented to determine the optimal additional experiments to conduct in order to minimize the variance in the output mean and standard deviation subject to a cost constraint. The number of additional experiments to add for each random variable depends upon several factors: the number of initial data points, the importance of the random variable in the response, the range of the random variable, and the cost of each experiment. The methodology is demonstrated using several numerical examples. The results indicate that the particle swarm optimization performs well and the solutions obtained are superior to ad hoc ones.

DTIC

Computerized Simulation; Monte Carlo Method; Optimization; Probability Density Functions; Simulation; Statistical Analysis

20100020282 Air Force Research Lab., Eglin AFB, FL USA

Finite Volume Algorithms for Heat Conduction

Nance, Douglas V.; May 2010; 48 pp.; In English

Contract(s)/Grant(s): Proj-2502; 62602F

Report No.(s): AD-A519644; AFRL-RW-EG-TR-2010-049; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Many modern computational fluid dynamics computer programs are developed by using the finite volume discretization method. It has an excellent numerical capability for capturing changes in conserved quantities such as mass, momentum and energy. In many cases, thermal energy is transferred from fluids to some adjacent solid mass. Head accumulation in this solid matter is an important engineering issue. To capture this energy transfer, it is important to have heat conduction algorithms that function well with fluid dynamics codes. The present work tackles this problem by presenting an algorithm for solving the heat equation in finite volume form. Although this derivation is cast in two dimensions, it may be readily generalized to three dimensions. Example problems are solved involving heat conduction within a section of an annular ring. Along the boundaries we enforce both Dirichlet and Neumann boundary conditions. For code validation, our numerical solutions, based

upon the Douglas-Rachford ADI time integration scheme, are compared with exact mathematical solutions.
DTIC
Algorithms; Alternating Direction Implicit Methods; Conductive Heat Transfer; Finite Element Method; Finite Volume Method; Heat Flux; Numerical Analysis; Thermal Conductivity

20100020295 Lawrence Livermore National Lab., Livermore, CA USA
Adaptive Waveform Correlation Detectors for Arrays: Algorithms for Autonomous Calibration
Ringdal, Frode; Gibbons, Steven J.; Harris, David B.; September 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-FC52-05NA26604; W-7405-ENG-48
Report No.(s): AD-A519777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Waveform correlation detectors compare a signal template with successive windows of a continuous data stream and report a detection when the correlation coefficient, or some comparable detection statistic, exceeds a given threshold. Since these methods exploit characteristic details of the full waveform, they provide exquisitely sensitive detectors with far lower detection thresholds than typical short-term average/long-term average (STA/LTA) algorithms. The drawback is that the form of the sought-after signal needs to be known quite accurately a priori, which limits such methods to instances of seismicity whereby a very similar signal has already been observed by every station used. Such instances include earthquake swarms, aftershock sequences, repeating industrial seismicity, and many other forms of controlled explosions. The reduction in the detection threshold is even greater when the techniques are applied to multiple channels since stacking can be performed on the correlation coefficient traces with a significant array-gain. A detected event that is co-located with the master event will record the same time-difference at every site in an arbitrarily spaced network which means that the correlation coefficient traces can be stacked coherently even when there is little or no similarity between the actual signals at the different sites. In the first year of this three-year investigation, the emphasis was upon estimating the detection threshold reduction for a range of highly repeating seismic sources using arrays of different configurations and at different distances from the events examined.
DTIC
Algorithms; Autonomy; Calibrating; Correlation Detection; Detectors; Waveforms

20100020297 ATK Launch Systems, Minneapolis, MN USA
Robust Magnitude and Path Corrections for Regional Seismic Phases in Eurasia by Constrained Inversion and Enhanced Kriging Techniques
Fisk, Mark D.; Taylor, Steven R.; Sepyember 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): AC52-06NA27321
Report No.(s): AD-A519755; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is to develop and test two methods to improve magnitude and path corrections for regional seismic phase amplitudes. Objectives of the first method, a constrained inversion approach, are to improve estimates of geometrical spreading and Q for Pn, Pg, Sn, Lg in Eurasia, by eliminating trade-offs with source corner-frequency estimates, and to improve source parameterizations, in terms of grids of stress drop and corner frequency scaling. Using waveform cross-correlations from Dr. Schaff of Lamont-Doherty Earth Observatory for 4,236 events prior to 2000 in Eurasia, (1) data were obtained for event pairs or clusters in a data set from Los Alamos National Laboratory (LANL); (2) additional seismograms from IRIS were incorporated; (3) regional phase picks were added; (4) network-averaged relative spectra (for large-over-small event pairs) were processed for Pn, Pg, Sn and/or Lg; and (5) relative spectra of a Brune model were fit to the empirical relative spectra. Cases were considered with the apparent stress-drop scaling parameter, (as defined by Walter and Taylor, 2002), as a free parameter or fixed at 0.0 or 0.25. Preliminary kriged grids of stress drop have been computed for Eurasia, based on relative spectra for individual phases and combining the results for the various phases. The results thus far seem to show that the scaling of corner frequency with seismic moment for earthquakes is very consistent among the various regional phases. An interesting observation is that the estimated P- and S-wave corner frequencies for a given event are very similar for a majority of earthquake pairs throughout many diverse areas of Eurasia, comparable to findings by Walter and Taylor (2002) for western U.S. earthquakes. Important implications of this result are discussed. These analyses have been automated and are being applied to almost 3600 earthquake pairs in Eurasia from 2000 to 2007.
DTIC
Amplitudes; Asia; Correction; Europe; Inversions; Kriging; Seismic Waves; Seismology

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20100018373 Internal Revenue Service, Washington, DC, USA
Special Studies in Federal Tax Statistics. 2006
Dalton, James; Gangi, Martha E.; March 2007; 135 pp.; In English
Report No.(s): PB2010-107451; No Copyright; Avail.: National Technical Information Service (NTIS)

This is the sixth edition of the IRS Methodology Report series Special Studies in Federal Tax Statistics, 2006. The papers included in this volume were presented in 2006 at the Joint Statistical Meetings of the American Statistical Association (ASA) held in Seattle, Washington, the National Tax Association's Annual Conference on Taxation held in Boston, Massachusetts, and the United Nations Statistical Commission and Economic Commission for Europe Conference of European Statisticians held in Geneva, Switzerland. This year's compilation has been divided into six areas of interest: The volume begins with four papers on the innovative uses of longitudinal panels, information documents, and time-series analysis; The second section presents three papers on IRS samples, surveys, and performance measurements; The third section contains a paper on tying Web site performance to mission achievement; The fourth section includes a paper on strategies to estimate a measure of heteroscedasticity; The fifth section contains three papers on special tax provisions for family-owned farms and closely held businesses, corporation life cycles, and the Free File Program; The final section presents a paper on improving customer utility on a centrally administered, shared Web site.
NTIS
Income; Revenue

20100018497 Fish and Wildlife Service, Washington, DC USA
Confidence Intervals and Hypothesis Tests for CWT Contribution Estimates Based on the Binomial-Hypergeometric Model
Comstock, Richard; October 1989; 17 pp.; In English
Report No.(s): PB2010-108208; No Copyright; Avail.: CASI: A03, Hardcopy

In this paper the author presents confidence intervals and tests of hypothesis for coded wire tag (CWT) contribution estimates. He discusses both nonreplicated and replicated experiments. The results presented in this paper were developed assuming the binomial-hypergeometric compound distribution model. This model supposes that the number of tagged fish caught in a fishery follows the binomial distribution and that the number of tagged fish sampled from a fishery follows the hypergeometric distribution.
NTIS
Binomials; Coding; Estimates; Fishes; Hypergeometric Functions; Hypotheses; Marking; Wire

20100018753 Deutsches Zentrum fuer Luft- und Raumfahrt e.V., Oberpfaffenhofen, Germany
Prototype of the DLR Operational Composite Clock: Methods and Test Cases
Suess, Matthias; Hammesfahr, Jens; Nov 2009; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518046; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518046

The operational implementation of the ensemble Kalman filter Composite Clock (CC developed by K. R. Brown), is the subject of this paper. Although the mathematical background of the CC is well-known, its autonomous and robust operation in a clock laboratory requires further modifications of the CC. The suitable initialization of the first ensemble estimate is discussed. Due to the fact, that only difference measurements are available, there is a dimensional degree of freedom in the first as in the following ensemble estimates. Furthermore, to guarantee a robust, consistent, and autonomous estimation of the ensemble clocks, a consistency check is described. It outputs a so-called consistency matrix which describes the active and non-active clocks. Since the identified active clocks can change from measurement to measurement, the corresponding Kalman filter (KF) parameters are adapted in a consistent way. Finally, the non-active clocks are estimated based on the KF output. The performance of the OCC using an ensemble of five DLR laboratory clocks, measured over a period of 1 year, is outlined. The clock ensemble consists of three high-performance cesium clocks (HP5071A), an active H-maser (CH1-75), and a GPS-disciplined Rb clock. Although miscellaneous anomalies like phase steps, outliers, and clock exclusions arise, the OCC

autonomously processes the five ensemble clocks and establishes a robust system time. Analysis results of this ensemble with different types of clocks when applying the OCC are presented.
DTIC
Clocks; Kalman Filters; Prototypes

20100019024 Naval Postgraduate School, Monterey, CA USA
On Solving Large-Scale Finite Minimax Problems using Exponential Smoothing
Pee, E Y; Royset, J O; Jan 2010; 37 pp.; In English
Report No.(s): AD-A518716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper focuses on finite minimax problems with many functions, and their solutions by means of exponential smoothing. We conduct run-time complexity and rate of convergence analysis of smoothing algorithms and compare them with those of SQP algorithms. We find that smoothing algorithms may have only sublinear rate of convergence, but as shown by our complexity results, their slow rate of convergence may be compensated by small computational work per iteration. We present two smoothing algorithms with active-set strategies that reduce the effect of ill-conditioning using novel precision-parameter adjustment schemes. Numerical results indicate that the proposed algorithms are competitive with other smoothing and SQP algorithms, and they are especially efficient for large-scale minimax problems with a significant number of functions e-active at stationary points.
DTIC
Exponential Functions; Minimax Technique; Smoothing

20100019375 University of South Florida, Tampa, FL, USA
American Community Survey (ACS) Statistical Analyzer
Chu, Xuehao; March 2010; 40 pp.; In English
Contract(s)/Grant(s): USDOT-DTRS98-G-0032
Report No.(s): PB2010-107526; NCTR788-02; BDK85 977-02; No Copyright; Avail.: CASI: A03, Hardcopy

The document provides guidance for using the ACS Statistical Analyzer. It is an Excel-based template for users of estimates from the American Community Survey (ACS) to assess the precision of individual estimates and to compare pairs of estimates for their statistical differences. The ACS Statistical Analyzer covers the following four functions and fifteen sub-functions (not listed); (1) to derive other precision measures for published ACS estimates at American Factfinder or from the Census Transportation Planning Products (CTPP), which already have a margin of error (MOE). (2) To derive the precision measures for estimates that do not already have an MOE. (3) To derive the precision measures of new estimates obtained from two or more original estimates that already have an MOE. (4) To compare pairs of two estimates that already have an MOE. Measures of precision for an estimate include its MOE, relative reliability, and confidence interval. The implementation of the ACS Statistical analyzer Is expected to reduce the agency cost of, and to lessen the technical barriers to, dealing with the precision of ACS estimates when agencies use these estimates. These direct benefits in turn can lead to wide and more effective usage of ACS data.
NTIS
Census; Statistical Analysis; Surveys

20100019439 NASA Langley Research Center, Hampton, VA, USA
Calibration Modeling Methodology to Optimize Performance for Low Range Applications
McCollum, Raymond A.; Commo, Sean A.; Parker, Peter A.; May 10, 2010; 12 pp.; In English; 7th International Symposium on Strain-Gauge Balances, 10-13 May 2010, Williamsburg, VA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 825855.04.03.04.04.50
Report No.(s): NF1676L-10685; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019439

Calibration is a vital process in characterizing the performance of an instrument in an application environment and seeks to obtain acceptable accuracy over the entire design range. Often, project requirements specify a maximum total measurement uncertainty, expressed as a percent of full-scale. However in some applications, we seek to obtain enhanced performance at the low range, therefore expressing the accuracy as a percent of reading should be considered as a modeling strategy. For example, it is common to desire to use a force balance in multiple facilities or regimes, often well below its designed full-scale capacity. This paper presents a general statistical methodology for optimizing calibration mathematical models based on a percent of reading accuracy requirement, which has broad application in all types of transducer applications where low range

performance is required. A case study illustrates the proposed methodology for the Mars Entry Atmospheric Data System that employs seven strain-gage based pressure transducers mounted on the heatshield of the Mars Science Laboratory mission. Author
Calibrating; Mathematical Models; Optimization; Linearity; Error Analysis; Statistical Analysis

20100019484 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Universidad Autonoma de Madrid, Spain; Amsterdam Univ., Netherlands; Hebrew Univ., Jerusalem, Israel
First Passage Process of a Markov Additive Process, with Applications to Reflection Problems
D'Auria, Bernardo; Ivanovs, Jevgenij; Kella, Offer; Mandjes, Michel; June 2009; 16 pp.; In English
Contract(s)/Grant(s): NWO-631.000.002; SFI04/RP1/I512
Report No.(s): PB2010-108107; PNA-E0908; Copyright; Avail.: National Technical Information Service (NTIS)
In this paper we consider the first passage process of a spectrally negative Markov additive process (MAP). The law of this process is uniquely characterized by a certain matrix function, which plays a crucial role in fluctuation theory. We show how to identify this matrix using the theory of Jordan chains associated with analytic matrix functions. Importantly, our result also provides us with a technique, which can be used to derive various further identities. We then proceed to show how to compute the stationary distribution associated with a one-sided reflected (at zero) MAP for both the spectrally positive and spectrally negative cases as well as for the two sided reflected Markov modulated Brownian motion; these results can be interpreted in terms of queues with MAP input.
NTIS
Fluctuation Theory; Markov Processes

20100019485 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Extremes of Markov-Additive Processes with One-Sided Jumps, with Queueing Applications
Dieker, A. B.; Mandjes, M.; February 2009; 38 pp.; In English
Contract(s)/Grant(s): NWO-631.000.002; SFI04/RP1/I512
Report No.(s): PB2010-108106; PNA-E0907; Copyright; Avail.: National Technical Information Service (NTIS)
Through Laplace transforms, we study the extremes of a continuous-time Markov-additive process with one-sided jumps and a finite-state background Markovian state-space, jointly with the epoch at which the extreme is attained. For this, we investigate discrete-time Markov-additive processes and use an embedding to relate these to the continuous-time setting. The resulting Laplace transforms are given in terms of two matrices, which can be determined either through solving a nonlinear matrix equation or through a spectral method. Our results on extremes are first applied to determine the steady-state buffer-content distribution of several single-station queueing systems. We show that our framework comprises many models dealt with earlier, but, importantly, it also enables us to derive various new results. At the same time, our setup offers interesting insights into the connections between the approaches developed so far, including matrix-analytic techniques, martingale methods, the rate-conservation approach, and the occupation-measuremethod. Then we turn to networks of fluid queues, and show how the results on single queues can be used to find the Laplace transform of the steady-state buffer-content vector; it has a matrix quasi-product form. Fluid-driven priority systems also have this property.
NTIS
Markov Processes; Queueing Theory; Transformations (Mathematics)

20100019486 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Lille Univ., France
Note on Pooling of Labels in Random Fields
Van Lieshout, M. N. M.; Stoica, R. S.; June 2009; 14 pp.; In English
Report No.(s): PB2010-108105; PNA-E0906; Copyright; Avail.: National Technical Information Service (NTIS)
This paper studies the effect on the interaction structure of merging labels in random field models.
NTIS
Marking; Markov Processes; Random Processes

20100019537 Raytheon Systems Co., El Segundo, CA USA
Negative Power Law Noise, Reality vs. Myth
Reinhardt, Victor S; Nov 2009; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518075; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518075
In this paper, it is shown that two popular conceptions about the behavior of negative power law (neg-p) noise - that is,

noise with a PSD Lp(f) alpha f p for p0 are based on myth and that the reality is quite different. The first myth is that one can fix a neg-p divergence problem in a variance like a standard or N-sample variance simply by replacing it with an Allan or Hadamard variance without further action. The paper will show that each type of variance has a different interpretation as an error measure and that such arbitrary swapping merely masks the true problem. In the process, we will show that such variance divergences are true indicators of severe system or modeling problems that must be physically addressed, not ignored. The second myth is that one can use ensemble-based statistical estimation techniques like least squares and Kalman filters to properly estimate polynomial deterministic behavior in data containing non-highpass filtered neg-p noise. It is demonstrated that such noise can generate highly anomalous fitting results because non-highpass-filtered neg-p noise is both infinitely correlated and non-ergodic. Thus, non-p noise is shown to act more like systematic error than conventional noise in such cases.
DTIC

Error Analysis; Statistical Analysis; Mathematical Models

20100019667 Library of Congress, Washington, DC USA

Afghanistan Casualties: Military Forces and Civilians

Chesser, Susan G; Apr 12, 2010; 6 pp.; In English

Report No.(s): AD-A518902; CRS-R41084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518902

This report collects statistics from a variety of sources on casualties sustained during Operation Enduring Freedom (OEF), which began on October 7, 2001, and is ongoing. OEF actions take place primarily in Afghanistan; however, OEF casualties also include American casualties in Pakistan, Uzbekistan, Guantanamo Bay (Cuba), Djibouti, Eritrea, Ethiopia, Jordan, Kenya, Kyrgyzstan, the Philippines, Seychelles, Sudan, Tajikistan, Turkey, and Yemen. Casualty data of U.S. military forces are compiled by the U.S. Department of Defense (DoD), as tallied from the agency's press releases. Also included are statistics on those wounded but not killed. Statistics may be revised as circumstances are investigated and as records are processed through the U.S. military's casualty system. More frequent updates are available at DoD's web site at http://www.defenselink.mil/news/ under Casualty Update. A detailed casualty summary of U.S. military forces that includes data on deaths by cause, as well as statistics on soldiers wounded in action, is available at the following DoD web site: http://siadapp.dmdc.osd.mil/personnel/CASUALTY/castop.htm. NATO's International Security Assistance Force (ISAF) does not post casualty statistics of the military forces of partner countries on the ISAF web site. For this reason, this report uses fatality data on coalition forces as compiled by CNN.com and posted online at http://www.cnn.com/SPECIALS/2004/oef.casualties/index.html. The casualty data on Afghan civilians contained in this report are reported quarterly by the United Nations Assistance Mission to Afghanistan (UNAMA). The deaths of Afghan National Police and Afghan National Army personnel contained in this report are reported by the Special Inspector General for Afghanistan Reconstruction in the quarterly reports to Congress that are required as part of P.L. 110-181.
DTIC

Afghanistan; Armed Forces; Casualties; North Atlantic Treaty Organization (NATO); Police; Security

20100019673 Naval Undersea Warfare Center, Newport, RI USA

Maximum Likelihood Estimates and Cramer-Rao Bounds for Map-Matching Based Self-Localization

Sarma, Ashwin; Jan 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518943; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518943

We describe a method to determine (x, y, z) position of a platform located in a region where a reference bathymetry map is available. The platform can be considered an Autonomous Undersea Vehicle (AUV) equipped with a multi-beam high frequency sonar. Estimates of the heading, pitch and roll are available through the onboard inertial navigation systems (INS). An estimate of the AUV depth from the ocean surface, altitude from a Doppler Velocity Logger (DVL) as well as the sound speed at the AUV depth are also available. The position (x, y, z) is determined based on these estimates as well as time delay estimates from the beam time series. The maximum likelihood estimate (MLE) is derived and connections between previous approaches are made. Theoretically based performance predictions are compared against MLE performance in real data. The new estimator is directly linked with the relief (or information) of the map and therefore allows for a direct estimate of accuracy. This insight is critical for integrated map-matching navigation systems but has hitherto been unavailable. The new estimator of location can constrain the error growth of a purely INS-based system and lead to improved navigation.
DTIC

Autonomous Navigation; Cramer-Rao Bounds; Maximum Likelihood Estimates; Position (Location); Underwater Vehicles

20100019681 Montclair State Coll., Upper Montclair, NJ USA

Controlling Interacting Systems in Noisy Environments

Billings, Lora; Dykman, Mark; Jan 11, 2010; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0320

Report No.(s): AD-A518960; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518960

The objective is to develop concepts for the analysis of the dynamics of interacting systems in a noisy environment. One of the central issues is dynamics of noise-induced switching. The phenomenon underlies a large portion of all significant changes that occur in systems in noisy environment. Examples range from breakdown events in complex systems to swarming in systems of interacting vehicles to overcoming barriers by such vehicles. Therefore understanding the switching dynamics is instrumental for developing highly efficient ways of controlling noisy environments.

DTIC

Mathematical Models; Stochastic Processes

20100019751 Naval Research Lab., Washington, DC USA

Maximal Sensitive Dependence and the Optimal Path to Epidemic Extinction

Forgoston, Eric; Bianco, Simone; Shaw, Leah B; Schwartz, Ira B; Jan 2010; 21 pp.; In English

Report No.(s): AD-A519129; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519129

Extinction of an epidemic or a species is a rare event that occurs due to a large, rare stochastic fluctuation. Although the extinction process is dynamically unstable, it follows an optimal path that maximizes the probability of extinction. We show that the optimal path is also directly related to the finite-time Lyapunov exponents of the underlying dynamical system in that the optimal path displays maximum sensitivity to initial conditions. We consider several stochastic epidemic models, and examine the extinction process in a dynamical systems framework. Using the dynamics of the finite-time Lyapunov exponents as a constructive tool, we demonstrate that the dynamical systems viewpoint of extinction evolves naturally toward the optimal path.

DTIC

Extinction; Sensitivity

20100019773 Army Medical Research Acquisition Activity, Fort Detrick, MD USA

DREAM3: Network Inference Using Dynamic Context Likelihood of Relatedness and the Inferelator

Madar, Aviv; Greenfield, Alex; Vanden-Eijnden, Eric; Bonneau, Richard; Mar 22, 2010; 14 pp.; In English

Report No.(s): AD-A519203; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA519203

Many current works aiming to learn regulatory networks from systems biology data must balance model complexity with respect to data availability and quality. Methods that learn regulatory associations based on unit-less metrics, such as Mutual Information, are attractive in that they scale well and reduce the number of free parameters (model complexity) per interaction to a minimum. In contrast, methods for learning regulatory networks based on explicit dynamical models are more complex and scale less gracefully, but are attractive as they may allow direct prediction of transcriptional dynamics and resolve the directionality of many regulatory interactions. We aim to investigate whether scalable information based methods (like the Context Likelihood of Relatedness method) and more explicit dynamical models (like Inferelator 1.0) prove synergistic when combined. We test a pipeline where a novel modification of the Context Likelihood of Relatedness (mixed-CLR, modified to use time series data) is first used to define likely regulatory interactions and then Inferelator 1.0 is used for final model selection and to build an explicit dynamical model. Our method ranked 2nd out of 22 in the DREAM3 100-gene in silico networks challenge. Mixed- CLR and Inferelator 1.0 are complementary, demonstrating a large performance gain relative to any single tested method, with precision being especially high at low recall values. Partitioning the provided data set into four groups (knock-down, knock-out, time-series, and combined) revealed that using comprehensive knock-out data alone provides optimal performance. Inferelator 1.0 proved particularly powerful at resolving the directionality of regulatory interactions, i.e. who regulates who (approximately 93% of identified true positives were correctly resolved). Performance drops for high in-degree genes, i.e. as the number of regulators per target gene increases, but not with out-degree.

DTIC

Inference; Networks

20100019927 Naval Academy, Annapolis, MD USA

Towards an Online Matching Mechanism for Kidney Paired Donation

Gentry, Sommer; Jan 2007; 4 pp.; In English

Report No.(s): AD-A519470; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Kidney paired donation (KPD) matches a recipient and his incompatible donor to another pair with a complementary incompatibility, such that the donor of the first pair gives to the recipient of the second and vice-versa. Recipients and their incompatible donors arrive one at a time seeking paired donation, but in order to use optimized matching, programs must require patients to wait many weeks or months for pairs to accumulate. On the other hand, if all recipients were instead matched immediately as they arrived, then the number of transplants achieved would be reduced by at least 20%, and the expected lifespan of the transplants would also suffer (1). We propose a radical alternative to our own optimization model of matching for paired donation. We will consider paired donation as a Markov Decision Process (MDP), a mathematical model for making a sequence of decisions in situations that evolve over time. Markov Decision Processes have been successfully employed, for example, to help liver recipients choose the best timing for their living donor transplantation (2). By calculating the best policy (sequence of decisions) for a kidney paired donation MDP, we can allow some, but not all, feasible paired donation matches to proceed to transplant immediately, while preserving the higher match rates achieved by optimization. Our results would offer clinical guidance, tailored to diverse KPD programs which differ in arrival rates and registry composition, about whether and which arriving incompatible pairs should wait before matching. The types of matches which should proceed immediately to transplant are those in which at least one of the pairs is a difficult-to-match pair. In contrast, pairs that are easier to match might be better reserved for a later arrival who will be looking for that particular needle in a haystack. Also, as large numbers of pairs accumulate in the pool, it will become more advantageous to match pairs immediately rather than add them to the pool.

DTIC

Compatibility; Kidneys; Mathematical Models; Transplantation

20100020008 Minnesota Univ., Minneapolis, MN USA

Ocean Stirring by Swimming Bodies

Thiffeault, Jean-Luc; Childress, Stephen; Mar 2010; 6 pp.; In English

Contract(s)/Grant(s): DMS-0507615; DMS-0806821

Report No.(s): AD-A519658; IMA-PREPRINT-SER-2301; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider the stirring of an inviscid fluid caused by the locomotion of bodies through it. The swimmers are approximated by non-interacting cylinders or spheres moving steadily along straight lines. We find the displacement of fluid particles caused by the nearby passage of a swimmer as a function of an impact parameter. We use this to compute the effective diffusion coefficient from the random walk of a fluid particle under the in influence of a distribution of swimming bodies. We compare with the results of simulations. For typical sizes, densities and swimming velocities of krill, the effective diffusivity in this model is five times the thermal diffusivity. However, we estimate that viscosity increases this value by two orders of magnitude.

DTIC

Athletes; Inviscid Flow; Marine Environments; Oceans; Stirring; Swimming

20100020009 Minnesota Univ., Minneapolis, MN USA

Discriminative Sparse Representations in Hyperspectral Imagery

Castrodad, Alexey; Xing, Zhengming; Greer, John; Bosch, Edward; Carin, Lawrence; Sapiro, Guillermo; Mar 2010; 6 pp.; In English

Report No.(s): AD-A519659; IMA-PREPRINT-SER-2302; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent advances in sparse modeling and dictionary learning for discriminative applications show high potential for numerous classification tasks. In this paper, we show that highly accurate material classification from hyperspectral imagery (HSI) can be obtained with these models, even when the data is reconstructed from a very small percentage of the original image samples. The proposed supervised HSI classification is performed using a measure that accounts for both reconstruction errors and sparsity levels for sparse representations based on class-dependent learned dictionaries. Combining the dictionaries learned for the different materials, a linear mixing model is derived for sub-pixel classification. Results with real hyperspectral data cubes are shown both for urban and non-urban terrain.

DTIC

Discriminant Analysis (Statistics); Imagery; Matrices (Mathematics)

20100020196 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Spacecraft Fault Management Workshop Results

Newhouse, Marilyn; McDougal, John; Barley, Bryan; Fesq, Lorraine; Stephens, Karen; April 25, 2010; 1 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, AL, USA

Contract(s)/Grant(s): NAS8-02060

Report No.(s): M09-0687; Copyright; Avail.: Other Sources; Abstract Only

Fault Management is a critical aspect of deep-space missions. For the purposes of this paper, fault management is defined as the ability of a system to detect, isolate, and mitigate events that impact, or have the potential to impact, nominal mission operations. The fault management capabilities are commonly distributed across flight and ground subsystems, impacting hardware, software, and mission operations designs. The National Aeronautics and Space Administration (NASA) Discovery & New Frontiers (D&NF) Program Office at Marshall Space Flight Center (MSFC) recently studied cost overruns and schedule delays for 5 missions. The goal was to identify the underlying causes for the overruns and delays, and to develop practical mitigations to assist the D&NF projects in identifying potential risks and controlling the associated impacts to proposed mission costs and schedules. The study found that 4 out of the 5 missions studied had significant overruns due to underestimating the complexity and support requirements for fault management. As a result of this and other recent experiences, the NASA Science Mission Directorate (SMD) Planetary Science Division (PSD) commissioned a workshop to bring together invited participants across government, industry, academia to assess the state of the art in fault management practice and research, identify current and potential issues, and make recommendations for addressing these issues. The workshop was held in New Orleans in April of 2008. The workshop concluded that fault management is not being limited by technology, but rather by a lack of emphasis and discipline in both the engineering and programmatic dimensions. Some of the areas cited in the findings include different, conflicting, and changing institutional goals and risk postures; unclear ownership of end-to-end fault management engineering; inadequate understanding of the impact of mission-level requirements on fault management complexity; and practices, processes, and tools that have not kept pace with the increasing complexity of mission requirements and spacecraft systems. This paper summarizes the findings and recommendations from that workshop, as well as opportunities identified for future investment in tools, processes, and products to facilitate the development of space flight fault management capabilities.

Author

Mission Planning; Flight Management Systems; Support Systems; Risk; Cost Analysis; Computer Programs

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SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20100018547 PPT Solutions, Inc., Huntsville, AL, USA

Phase Two Feasibility Study for Software Safety Requirements Analysis Using Model Checking

Turgeon, Gregory; Price, Petra; Proceedings of the Second NASA Formal Methods Symposium; April 2010, pp. 129-138; In English; See also 20100018529; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100018547

A feasibility study was performed on a representative aerospace system to determine the following: (1) the benefits and limitations to using SCADE , a commercially available tool for model checking, in comparison to using a proprietary tool that was studied previously [1] and (2) metrics for performing the model checking and for assessing the findings. This study was performed independently of the development task by a group unfamiliar with the system, providing a fresh, external perspective free from development bias.

Author

Aerospace Systems; Program Verification (Computers); Software Reliability; Systems Analysis; Systems Engineering; Functional Design Specifications; Requirements

20100018599 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

A Multi-Objective Approach to a Bipartite Assignment Matching Problem Using Weighted Values from Multiple Contraints

Jeong, Greg S; Mar 15, 2010; 94 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517411; AFIT/OR/MS/ENS/10-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517411

US Air Force recruiters routinely assign new recruits to available jobs every month. The goal is to find the best assignments in an efficient manner. Although this problem is modeled as a bipartite assignment matching problem, it is not new to the field of Operations Research. This research presents a new approach to solve assignment matching problems given multiple side constraints. Using two multi-criteria optimization techniques, lexicographic optimization and the elastic constraint method, the assignment matching algorithm efficiently produces an optimal solution in a fraction of the time currently spent. This approach is demonstrated in assigning new USAF recruits to available jobs in any given month for the 369th Recruiting Squadron. The current 369th process manually creates assignments and can take weeks to complete, whereas the assignment matching algorithm takes less than two seconds and, on average, shows an increase in user defined goals of at least 15%.

DTIC

Algorithms; Operations Research

20100018642 Amsterdam Univ., Netherlands

From Blogs to News: Identifying Hot Topics in the Blogosphere

Weerkamp, Wouter; Tsagkias, Manos; de Rijke, Maarten; Nov 2009; 5 pp.; In English

Report No.(s): AD-A517750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517750

We describe the participation of the University of Amsterdam's ILPS group in the blog track at TREC 2009. We focus on the top stories identification task, and take an approach that does not require the headlines of top stories to be known beforehand. We explore the feasibility of a so-called blogs to news approach: given a date and a set of blog posts, identify the main topics for that date. This approach is more general than just finding top stories, but it can still be applied to the task of headline ranking. Results show that this general approach, applied to the task at hand, is among the top performing approaches in this year's TREC.

DTIC

Identifying; Preprocessing

20100018716 Rensselaer Polytechnic Inst., Troy, NY USA

Adaptive Multiscale Analysis of Deposition Processes

Shephard, Mark S; Flaherty, Joseph E; Jan 12, 2010; 4 pp.; In English

Contract(s)/Grant(s): W911NF-05-1-0411

Report No.(s): AD-A517961; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517961

Increasingly the models used for many problems of importance must address phenomena occurring on space and time scales ranging over orders of magnitude including electronic, atomic, micro-structural, and system-wide effects. The methods being developed to address these problems face challenging issues including selecting the models for each relevant scale and the coupling information between scales. This project is developing a component-based environment for adaptive multiscale simulation.

DTIC

Deposition; Mathematical Models; Scale Models

20100018802 Carnegie-Mellon Univ., Pittsburgh, PA USA

Strengthening Schedules Through Uncertainty Analysis

Hiatt, Laura M; Zimmerman, Terry L; Smith, Stephen F; Simmons, Reid; Jul 2009; 7 pp.; In English

Contract(s)/Grant(s): FA8750-05-C-0033

Report No.(s): AD-A518169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518169

In this paper, we describe an approach to scheduling under uncertainty that achieves scalability through a coupling of

deterministic and probabilistic reasoning. Our specific focus is a class of oversubscribed scheduling problems where the goal is to maximize the reward earned by a team of agents in a distributed execution environment. There is uncertainty in both the duration and outcomes of executed activities. To ensure scalability, our solution approach takes as its starting point an initial deterministic schedule for the agents, computed using expected duration reasoning. This initial agent schedule is probabilistically analyzed to find likely points of failure, and then selectively strengthened based on this analysis. For each scheduled activity, the probability of failing and the impact that failure would have on the schedule's overall reward are calculated and used to focus schedule strengthening actions. Such actions generally entail fundamental trade-offs; for example, modifications that increase the certainty that a high-reward activity succeeds may decrease the schedule slack available to accommodate uncertainty during execution. We describe a principled approach to handling these trade-offs based on the schedule's expected reward, using it as a metric to ensure that all schedule modifications are ultimately beneficial. Finally, we present experimental results obtained using a multi-agent simulation environment, which confirm that executing schedules strengthened in this way result in significantly higher rewards than are achieved by executing the corresponding initial schedules.

DTIC

Artificial Intelligence; Schedules; Scheduling

20100018806 Army Command and General Staff Coll., Fort Leavenworth, KS USA

The Art of Design: A Design Methodology

Banach, Stefan J; Ryan, Alex; Apr 2009; 12 pp.; In English

Report No.(s): AD-A518192; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518192

The purpose of this article is to describe a methodology for design to account for what military designers do and how they do it when they are confronted with a complex situation. This description is a snapshot of an evolving approach that encourages critical thought, innovation, and creativity, and as such should not be taken as prescriptive or limiting. Rather, the intent is to document current best practices to provide sufficient design guidelines for successful planning to occur. This narrative describes how design informs planning and action. It then introduces the prerequisite theory needed to explain the art of design and provides a brief overview of an approach for developing a comprehensive response to a complex situation. America's International Technology Education Association defines design as an iterative decision-making process that produces plans by which resources are converted into products or systems that meet human needs and wants or solve problems. According to this definition, design is iterative, meaning it does not follow a linear sequence, and it does not terminate just because a solution has been developed. Because design can be used to produce systems, not just products, and is applicable to the spectrum of human needs and wants, design is both extremely general and ubiquitous in nature. The definition implies that design is focused on solving problems, and as such requires intervention, not just understanding. Whereas scientists describe how the world is, designers suggest how it might be. It follows that design is a central activity for the military profession whenever it allocates resources to solve problems, which is to say design is always a core component of operations. As a professional intellectual activity, design requires both practical experience and theoretical support. Mastery of a profession can only come through mentoring, coaching, and experiential learning as a member of a community of practice, in addition to the appropria

DTIC

Decision Making; Military Operations; Planning

20100018890 Naval Postgraduate School, Monterey, CA USA

A Training Transfer Study of Simulation Games

Brown, Ben; Mar 2010; 308 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518353; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Throughout history, military warriors have used games to accomplish training objectives. Recently, personal computer-based games have emerged as viable training platforms. In this research project, we evaluated the training effectiveness of simulation games using a particular proprietary first-person view tactical trainer called Virtual Battlespace 2(TM). Specifically, we examined squad level tactical maneuver of a combat convoy in a semi-permissive environment. We found that personal computer-based gaming was at least as effective as traditional training methods such as the sand table for preparatory tactical training. We found that trainees felt better trained after operating in the virtual environment. We also conducted an experiment to determine the extent to which the training of the simulation controller influences the effectiveness of the simulation. We found that the facilitator role can detract from a trainer's focus and that the trainer's practice and experience greatly affect the simulation training. Our findings justify the use of personal computer-based games for small unit tactical training. We conclude

that personal computerbased gaming at the unit level can be a training multiplier, but the capability of the unit trainers to administer virtual training plays a large role in determining the effectiveness of the training tool.
DTIC
Education; Game Theory; Games; Simulation; Training Devices; Virtual Reality

20100018936 Naval Research Lab., Bay Saint Louis, MS USA
Real-Time Coastal Monitoring and Prediction for Operations and Research
Book, J W; Martin, P; Rixen, M; Dykes, J; Wang, D; Ladner, S; Tudor, M; Chiggiato, J; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518485; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The coastal ocean is often characterized by vigorous, swiftly evolving fronts and eddies. These features bound waters of different characteristics and can have a high impact on operations and sensor performance. However, their complex dynamics make monitoring and prediction challenging. These features and other environmental conditions must be identified or forecast in near real time so that sampling can be designed to study them and operations can be modified to optimize performance based on their impact. This topic was one of the main research thrusts of a recent Joint Research Project (JRP) between the Naval Research Laboratory (NRL) and the NATO Undersea Research Centre (NURC). In the framework of this JRP, an international, collaborative research effort was developed involving more than 20 different research groups from seven countries. The research focused on winter and summer experiments in the central Adriatic Sea, an archetypal coastal area for fronts and eddies. NRL, in collaboration with the other institutions, implemented and tested a complete, real-time, coastal monitoring and prediction system during three ?Dynamics of the Adriatic in Real-Time? (DART) cruises. Here we describe some tangible results and implications of the real-time monitoring and prediction thrust of this work.
DTIC
Coasts; Operations Research; Prediction Analysis Techniques; Real Time Operation

20100018944 Naval Postgraduate School, Monterey, CA USA
Testbed for Tactical Networking and Collaboration
Bordetsky, Alex; Netzer, David; Jan 2010; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518509; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Beginning in 2002, a team of Naval Postgraduate School researchers together with sponsors from the USA Special Operations Command (USSOCOM), and later joined by the Office of the Secretary of Defense (OSD) and the Department of Homeland Security (DHS) S&T Programs, started a new interagency experimentation program, which is now collectively known as the Tactical Network Testbed (TNT) Experiments. An observed general lack of synergy between military operators, government labs, industry, and the academic community in resolving increasingly complex problems of integrating and operating emerging technologies motivated the project. In the core of TNT experimentation is a unique testbed, which enables sustainability and evolution of the experimentation process. It provides for the adaptation and integration processes between people, networks, sensors, and unmanned systems. It enables plug-and-play tactical-on-the-move sensor-unmanned systems networking capabilities combined with global reachback to remote expert/ command sites and augmentation by rapid integration of applied research services. The goal for this paper is to describe an innovative interagency experimentation testbed environment which has evolved into a unique research service of social and information networking, enabling synergy of the military, academic, government, and industrial communities in designing, operating, and evaluating emerging self-organizing tactical networks as well as other related technologies.
DTIC
Military Technology; Networks; Research and Development

20100018948 Naval Postgraduate School, Monterey, CA USA
Heuristics in Global Combat Logistics Force Operational Planning
Diaz, Andres; Mar 2010; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518533; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Navy (USN) globally deploys to protect and sustain a peaceful international system of interdependent trade, information, and social networks through a spectrum of capabilities, including humanitarian aid missions, multinational engagement, maritime domain awareness, and combat operations. To sustain maritime forces at sea, the Combat Logistics Force (CLF) provides logistical support via Underway Replenishments (UNREP) that maximizes deployed battle group on-station-time and endurance. The author presents a heuristic algorithm extension to the legacy CLF planning tool to plan Combat Logistics Force shuttle ship schedules to support forward deployed U.S. Navy battle groups operating globally. This

algorithm prioritizes each battle group's replenishment requirements based on supply and determines an effective Combat Logistics Force shuttle ship pairing to execute at-sea replenishment. This determination is based on a variety of factors including range between shuttle ship and battle group, on hand commodity levels, and shuttle availability. The Replenishment-At-Sea schedules provided by the heuristic are face-valid, and can be used as initial feasible solutions for more complex and time-consuming algorithms. The legacy CLF model relies on the CPLEX solver engine and integer linear programming algorithms to determine optimal scheduling solutions. However, each solve run is time-consuming, with a processing time for larger scenarios requiring between 2-10 hours for completion, and can require 5 minutes to an hour just to find an initial feasible solution. On the contrary, a heuristic algorithm can provide initial feasible solutions in a matter of seconds.
DTIC
Combat; Heuristic Methods; Logistics; Logistics Management; Operational Problems; Organizations; Planning; Replenishment; Scheduling; Seas

20100019029 Joint Staff, Washington, DC USA
Adaptive Planning: Not Your Great Grandfather's Schlieffen Plan
Klein, Robert M; Jan 2007; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On December 13, 2005, Secretary of Defense Donald Rumsfeld approved the Adaptive Planning (AP) Roadmap and directed its expeditious implementation. This act represented a significant shift in the way the Department of Defense (DOD) thinks about military planning. The impetus for change was a recognition that the accelerating pace and complexity of military operations require that the President, Secretary of Defense, and combatant commanders have the ability to respond quickly to new threats and challenges. Adaptive Planning is the joint capability to create and revise plans rapidly and systematically, as circumstances require. It occurs in a networked, collaborative environment, requires the regular involvement of senior leaders, and results in plans containing a range of viable options that can be adapted to defeat or deter an adversary to achieve national objectives. At full maturity, AP will form the backbone of a joint adaptive system supporting the development and execution of plans, preserving the best characteristics of present-day contingency and crisis planning with a common process. The need to overhaul the DOD planning and execution system becomes more evident when it is viewed against the backdrop of history. Planning today is a late 19th-century concept born out of the German general staff system. It thus seems fitting that a discussion about transforming the planning process begins with the history of the Schlieffen Plan.
DTIC
Adaptation; Military Operations; Planning

20100019180 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Supply Chain Resilience: Assessing USAF Weapon System Life Cycle
Tobin, Brian P; Mar. 2010; 102 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517907; AFIT/LSCM/ENS/10-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517907

The Air Force Global Logistics Support Center (AFGLSC) is responsible for the USA Air Force's supply chain. One of the AFGLSC's focus areas is to improve Air Force supply chain processes. Imbedded in this focus area is the requirement to define and deploy a supply chain risk management program. Supply chain resilience has been identified as a method of enhancing traditional risk management associated with commercial supply chains both in recent literature and research. This leads to the problem statement: Does recent literature and research provide AFGLSC with a method to enhance current supply chain risk management with supply chain resilience? A literature review identified a supply chain resilience framework and measurement tool that could be of potential benefit to Air Force supply chain managers. The Supply Chain Resilience Assessment and Management (SCRAM (trademark)) tool is used to measure current supply chain vulnerabilities and capabilities, provide recommendations for improvements, and provide information to better prepare supply chain leadership with managing products, processes, and relationships. Eleven Air Force weapon systems were identified and organized into two groups based on their current position (phase) within the weapon system life cycle. Phase I is identified as weapon systems from conception through production and Phase II is identified as weapon systems from post production through disposal. SCRAM was used to measure the vulnerabilities and capabilities of each USAF weapon system to determine if differences existed as they progressed through the weapon system life cycle. The results indicate that the supply chain resilience framework and measurement tool provide Air Force leadership with the information they need to improve the strategic management of their supply chain.
DTIC
Life (Durability); Logistics Management; Optimization; Resilience; Risk; Weapon Systems

20100019181 Army War Coll., Carlisle Barracks, PA USA

Making JCIDS Work for the Warfighter

Cherry, Douglas; Mar. 2010; 31 pp.; In English

Report No.(s): AD-A517906; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517906

All military acquisition programs begin with an identified and validated requirement. The Joint Capabilities Integration and Development System (JCIDS) as described in CJCSI 3170.01G is the joint guidance used to manage the requirements process. Recognizing many deficiencies in the process as outlined in the 1 MAY 07 instruction, a complete re-write was undertaken and signed into implementation on 1 MAR 09. This revision streamlined the process but the current system, as implemented by the Joint Staff and the Army, in accordance with Army Regulation 71-9, is still too time-consuming to support the joint warfighters' needs in an environment that is technologically complex and rapidly changing. Furthermore, the current Army organization for requirements generation often results in requirements that are not producible at an affordable price or on a schedule that supports the warfighter. The Army must embrace greater service inter-dependence and institute a more disciplined and restrained requirements process by streamlining its own organization and procedures and by involving its most senior leaders more frequently and earlier in the process.

DTIC

Acquisition; Military Operations; User Requirements

20100019300 Illinois Univ., Urbana-Champaign, IL USA

A Study of Term Proximity and Document Weighting Normalization in Pseudo Relevance Feedback - UIUC at TREC 2009 Million Query Track

Lv, Yuanhua; He, Jing; Vydiswaran, V G; Ganesan, Kavita; Zhai, Cheng X; Nov 2009; 6 pp.; In English

Report No.(s): AD-A517768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517768

In this paper, we report our experiments in the TREC 2009 Million Query Track. Our first line of study is on proximity-based feedback, in which we propose a positional relevance model (PRM) to exploit term proximity evidence so as to assign more weights to expansion words that are closer to query words in feedback documents. The second line of study is to improve the weighting of feedback documents in the relevance model by using a regression-based method to approximate the probability of relevance (and thus the name RegRM). In the third line of study, we test a supervised approach for query classification. Besides, we also evaluate a selective pseudo feedback strategy which stops pseudo feedback for precision-oriented queries and only uses it for recall-oriented ones. The proposed PRM has shown clear improvements over the relevance model for pseudo feedback, suggesting that capturing the term proximity heuristic appropriately could lead to a better feedback model. RegRM performs as well as relevance model, but no noticeable improvement is observed. Unfortunately, the proposed query classification methods appear to not work well. The results also show that the proposed selective pseudo feedback may not work well, since precision-oriented queries can also benefit from pseudo feedback, though not as much as recall-oriented queries.

DTIC

Feedback; Words (Language); Classifications

20100019301 Waterloo Univ., Ontario Canada

Experiments with ClueWeb09: Relevance Feedback and Web Tracks

Smucker, Mark D; Clarke, Charles L; Cormack, Gordon V; Nov 2009; 6 pp.; In English

Report No.(s): AD-A517764; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517764

In this paper, we report on our TREC experiments with the ClueWeb09 document collection. We participated in the relevance feedback and web tracks. While our phase 1 relevance feedback run's performance was good, our other relevance feedback and web track submissions' performances were lacking. We suspect this performance difference is caused by the Category B document subset of the ClueWeb09 collection having a higher prior probability of relevance than the rest of the collection. Future work will involve a more detailed error analysis of our experiments.

DTIC

Feedback; Error Analysis

20100019348 Army War Coll., Carlisle Barracks, PA USA
Making Constructive Simulations Relevant for Today's Fight
Reedy, Stanley E; Mar. 8, 2010; 27 pp.; In English
Report No.(s): AD-A518308; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In modern warfare, overwhelming the enemy with combat power and holding key terrain may not guarantee success. Modern warfare is taking place in urban areas populated with a mix of military forces, insurgents, religious groups, factions and tribes. This warfare focuses on interactions with the populace who are key to insuring military success. Leaders must understand both the strategic implications and the local cause and effect of their military operations. Damaging or destroying homes and religious facilities and injuring or killing civilians has significant effect on the relationships of these groups with each other and the U.S. Military. This paper investigates potential ways to use Army constructive simulations to help teach soldiers and leaders the intricacies of dealing with the diverse cultures of a populace, similar to what the military is experiencing today in Iraq and Afghanistan. Alternative solutions for providing these capabilities will be reviewed, concluding with a recommendation for a long-term solution to assist in training soldiers and leaders.
DTIC
Computer Programs; Education; Simulation; War Games

20100019405 Defence Science and Technology Organisation, Canberra, Australia
Technical Description of the Go*Team User Interface
Jagiello, Jerzy; June 2009; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518098; DSTO-TN-0899; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518098

There is a need for analysis of the human aspects of network warfare. Go*Team is a game that creates an opportunity for cooperation and coordination between teams and individuals. By creating a simple competitive and collaborative environment where players compete against each other as individuals and as teams, human factors may be identified which could have a profound impact on the outcomes of future Network Centric Warfare wars. Go*Team is based on the traditional game of Go in which players place black and white stones onto a board in order to occupy territory on the board. Go*Team is designed to allow a number of competing teams to play Go with a number of players in each team. Every player on a team has a local view of the game. Players on the same team must collaborate if they want to have a more complete picture of the actual game state. Go*Team game has been designed as a research vehicle for investigating collaboration and cooperation between team members in a competitive and dynamic environment. The Go*Team has been extensively used to conduct simulation experiments in teaming environment by both DSTO and University of Wollongong.
DTIC
Game Theory; Human-Computer Interface

20100019545 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Amsterdam Univ., Netherlands; Stanford Univ., Stanford, CA USA
Simulation-Based Computation of the Workload Correlation Function in a Levy-Driven Queue
Glynn, P. W.; Mandjes, M.; January 2009; 16 pp.; In English
Report No.(s): PB2010-108109; PNA-E0911; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we consider a single-server queue with Levy input, and in particular its workload process (Q underline t), focusing on its correlation structure. With the correlation function defined as r(t): = Cov(Q underline 0, Q underline t)/Var Q underline 0 (assuming the workload process is in stationarity at time 0), we first study its Laplace transform, both for the case that the Levy process has positive jumps, and that it has negative jumps. These expressions allow us to prove that r(sigma) is positive, decreasing, and convex, relying on the machinery of completely monotone functions. For the light-tailed case, we estimate the behavior of r(t) for t large. We then focus on techniques to estimate r(t) by simulation. Naive simulation techniques require roughly (r(t))(sup -2) runs to obtain an estimate of a given precision, but we develop a coupling technique that leads to substantial variance reduction (required number of runs being roughly (r(t))(sup -1)). If this is augmented with importance sampling, it even leads to a logarithmically efficient algorithm.
NTIS
Correlation; Simulation; Workloads (Psychophysiology)

20100019631 Naval Academy, Annapolis, MD USA
Strategic Entry Deterrence and Terrorism: Theory and Experimental Evidence
Cadigan, John; Schmitt, Pamela M; Jan 2009; 21 pp.; In English
Report No.(s): AD-A518776; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518776

Using a two stage rent-seeking framework, we present a simple model of strategic entry/terrorism deterrence and test the model using laboratory experiments. Our contest success function highlights the potential for strategic spillovers. The theory illustrates that, relative to a cooperative outcome, negative externalities lead to over-spending on deterrence and positive externalities lead to under-spending on deterrence. Our experimental results are broadly consistent; subjects in the negative externality treatment had higher expenditures. In contrast to theoretical predictions, participation decisions, while primarily driven by the probability of winning a contest, were influenced by a subject's ability to participate in multiple contests.
DTIC
Game Theory; Terrorism

20100019672 General Accounting Office, Washington, DC USA
Best Practices: DOD Can Achieve Better Outcomes by Standardizing the Way Manufacturing Risks are Managed
Apr 2010; 75 pp.; In English
Report No.(s): AD-A518940; GAO-10-439; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518940

Cost growth and schedule delays are prevalent problems in acquiring defense weapon systems. Manufacturing systems has proven difficult, particularly as programs transition to production. In December 2008, the Department of Defense (DOD) issued an updated version of its acquisition policy that reflects earlier consideration of manufacturing risks. A joint defense and industry group developed manufacturing readiness levels (MRL) to support assessments of manufacturing risks. Use of MRLs on all weapon acquisition programs has been proposed. In response to a congressional request, this report assesses the manufacturing problems faced by DOD, how MRLs can address manufacturing problems, how MRLs compare to manufacturing best practices of leading commercial firms, and challenges and barriers to implementing MRLs at DOD. In conducting our work, we contacted DOD, military services, and contractors; held interviews with leading commercial firms; reviewed program documents and policy proposals; and spoke with manufacturing experts.
DTIC
Manufacturing; Risk; Standardization

20100019677 Army Engineer Research and Development Center, Vicksburg, MS USA
Demonstration of a Coupled Watershed-Nearshore Model
Cheng, Hwai-Ping; Cheng, Jing-Ru C; Hunter, Robert M; Lin, Hsin-Chi; Apr 2010; 27 pp.; In English
Report No.(s): AD-A518953; ERDC-TN-SWWRP-10-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518953

This technical note documents a research demonstration of a newly-developed watershed-nearshore computational model, which couples the parallel WAterSHed systems of one-dimensional (1-D) stream-river networks, two-dimensional (2-D) overland regimes, and three-dimensional (3-D) subsurface media (pWASH123D) model with the 2-D ADvanced CIRCulation model for oceanic, coastal, and estuarine waters (ADCIRC). This task was sponsored by the System-Wide Water Resources Program (SWWRP). It was conducted through the simulation of water flow in a simplified Biloxi Bay hydro-system.
DTIC
Hurricanes; Hydrology Models; Mathematical Models; Simulation; Watersheds

20100019750 Memphis Univ., Memphis, TN USA
Game Theoretic Approaches to Protect Cyberspace
Shiva, Sajjan; Dasgupta, Dipankar; Wu, Qishi; Apr 20, 2010; 88 pp.; In English
Contract(s)/Grant(s): N00014-09-1-0752
Report No.(s): AD-A519126; CS-10-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519126

The area of cyberspace defense mechanism design has received immense attention from the research community for more than two decades. However, the cyberspace security problem is far from completely solved. In this project we explored the

applicability of game theoretic approaches to address some of the challenging cyber security issues: (a) We built a state-of-the-art attack taxonomy which can provide the system administrator with information on how to mitigate or remediate an attack, (b) We conducted a thorough survey of the existing game-theoretic solutions to cyber security problems and proposed a detailed taxonomy, which points out that this area requires more attention from the research community, (c) We proposed stochastic game models for generic cyber activities (attacks and defenses), which eliminate the unrealistic assumptions of the existing models. We validated the effectiveness of our model via extensive simulation, (d) We modeled the interaction between a class of attacks (such as the Denial of Service (DoS) and Distributed Denial of Service (DDoS)) and the possible countermeasures as a two-player general-sum game. We validated our analytical results via simulation experiments, (c) We compiled a set of metrics which can evaluate the cost and benefit of a game-theoretic defense solution. In addition, we have proposed a Game Theory Inspired Defense Architecture (GIDA).
DTIC
Cybernetics; Game Theory; Security

20100019906 Carnegie-Mellon Univ., Pittsburgh, PA USA
The STAR System: A Unified Multi-Agent Simulation Model of Structure, Task, Agent, and Resource
Kaplan, David J; Feb 24, 1999; 59 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0037; NSF-IRI9633662
Report No.(s): AD-A519430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Managers are continually designing and redesigning their teams and organizations. Design decisions tend to be based on trial and error, with little attention to long term experience and little or no attempt at verification. Organizational researchers interested in design have generated a vast compendium of design knowledge, much of which goes under the heading - Contingency Theory. As the name implies, the right design for an organization is seen to be contingent on a large number of complex and interacting factors. The complexity of the findings is such that, on the practical side, little guidance can be given to the manager and, on the theoretical side, advances in understanding are hampered by the overwhelming complexity. Computational models are ideally suited for reasoning about large complex systems composed of multiple interacting parts. This thesis addresses these pragmatic and theoretical problems by developing a computational toolkit for reasoning about organizational design that can be used to design teams or organizations, examine the impact of design changes, and reason theoretically about organizational design. The proposed toolkit, referred to as the STAR (Structure, Task, Agent, Resource) system, integrates a set of building block modules into a flexible agent oriented framework that can be used to model and simulate organizations and evaluate alternative designs. The development of this toolkit will advance both our theoretical understanding of organizations and our methodologies for reasoning about, and evaluating different, designs. Using this toolkit I will demonstrate the utility of a new theoretical proposition, permeability, and the benefit of a new method for engineering organizational designs, organizational morphing.
DTIC
Mathematical Models; Operations Research; Organizations; Simulation

20100019909 California Univ., San Diego, La Jolla, CA USA
Evaluation of Infrasonic Spatial Filters
Hedlin, Michael A; Berger, Jn; Zumberge, Mark; Sep 2000; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The infrasound element of the global International Monitoring System (IMS) will consist of 60 stations. Each station in the global network will consist of an array of sensors. As the local surface wind strongly influences ambient infrasonic noise levels in the band of interest to the nuclear treaty monitoring community (between 0.05 and 4 Hz), each of these sensors will include a spatial filter designed to reduce the effects of wind noise. There are, however, many different design suggestions for spatial filtering system. In order to maximize the signal-to-noise ratio of signals of interest, it is essential that the spatial noise reduction systems be optimized to provide the most significant noise power reduction over the broadest band possible. We believe that substantial progress in these areas requires the comparative testing of the major noise reducing systems exposed to the same meteorological conditions. Under our new DTRA contract we will construct and test several spatial filtering systems by simultaneous operation at the Pinon Flat Observatory (PFO) in southern California. These systems include the wind fence, microporous pipes, and a recent design in which a large number of open ports are connected to a summing manifold, and then to the microbarometer, by solid pipes. We will also compare these mechanical noise suppression schemes with a new design based on light-speed pressure averaging via optical fibres. The observatory is an ideal test site as it is

subjected to winds that come from all azimuths at speeds ranging from 0 to over 10 m/s.
DTIC
Infrasonic Frequencies; Spatial Filtering

20100020006 Minnesota Univ., Minneapolis, MN USA
Collaborative Hierarchical Sparse Modeling
Sprechmann, Pablo; Ramirez, Ignacio; Sapiro, Guillermo; Eldar, Yonina; Mar 2010; 8 pp.; In English
Report No.(s): AD-A519655; IMA-PREPRINT-SER-2299; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sparse modeling is a powerful framework for data analysis and processing. Traditionally, encoding in this framework is done by solving an (l)1-regularized linear regression problem, usually called Lasso. In this work we first combine the sparsity-inducing property of the Lasso model, at the individual feature level, with the block-sparsity property of the group Lasso model, where sparse groups of features are jointly encoded, obtaining a sparsity pattern hierarchically structured. This results in the hierarchical Lasso, which shows important practical modeling advantages. We then extend this approach to the collaborative case, where a set of simultaneously coded signals share the same sparsity pattern at the higher (group) level but not necessarily at the lower one. Signals then share the same active groups, or classes, but not necessarily the same active set. This is very well suited for applications such as source separation. An efficient optimization procedure, which guarantees convergence to the global optimum, is developed for these new models. The underlying presentation of the new framework and optimization approach is complemented with experimental examples and preliminary theoretical results.
DTIC
Coding; Optimization; Signal Processing

20100020164 NASA Johnson Space Center, Houston, TX, USA
Automation of Space and Ground Inventory Management Systems
Fink, Patrick W.; Chu, Andrew; Kennedy, Timothy F.; Ngo, Phong H.; Brown, Tim; Hartwell, William; Gaines, Darryl; Stonestreet, Robert; Gifford, Kevin K.; [2010]; 26 pp.; In English; Consultative Committee for Space Data Systems (CCSDS) Spring Technical Meeting, 5-7 May 2010, Portsmouth, VA, USA; Original contains color illustrations
Report No.(s): JSC-CN-20550; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020164

The presentation examines BCR radio frequency identification (BCR/RFID) hardware, integrated RFID over a delay/disruption tolerant network (DTN), and pilot projects for RFID for center operations.
CASI
Radio Frequencies; Inventory Management; Management Systems

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THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20100018910 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling Computer Communication Networks in a Realistic 3D Environment
Rowell Jr, Charles R; Mar 2010; 98 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-10-336
Report No.(s): AD-A518401; AFIT/GCE/ENG/10-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Communication network simulations have typically been visualized in the past through 2D representations, but this is insufficient for battlefield network scenarios. Visual representations of battlefield networks greatly benefit from 3D visualization due to its ability to retain asset location. This research investigates the feasibility of modeling a typical battlefield communication network in a realistic 3D manner and discusses the effects of doing so. The result is an open source, 3D network visualization tool that can create highly intuitive connected battlefield scenes, enabling the user to quickly comprehend network state. It highlights mobile assets, packet movement, and node connectivity while allowing the viewer to interact with the scene.
DTIC
Computer Graphics; Interprocessor Communication; Mathematical Models; Network Analysis; Scene Generation; War Games

20100018978 New York Univ., New York, NY USA
Fractional Kinetics of Chaotic Dynamics of Particles in Complex Systems
Weitzner, Harold; Edelman, Mark; Tarasov, Vasily; Dec 31, 2009; 41 pp.; In English
Contract(s)/Grant(s): N00014-08-1-0121; Proj-10PR02413-00
Report No.(s): AD-A518612; 25-74100-F6693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The illness and death of G. M. Zaslavsky caused significant shifts in the work carried out under this grant. Nonetheless it was possible for the remaining research scientists originally intended to be supported by the grant, Dr. Mark Edelman and Dr. Vasily Tarasov, to work in the broad directions laid out in the proposal. In three papers, which are attached, they were able to set up fractional differential equation to represent the evolution of the particle distribution function for systems of physical interest and relevance. The first paper dealt with a variation of the standard map, the second of a system with memory, and the third with a dissipative system. In each case it was possible to identify solutions of the continuous fractional kinetic equation with the properties of a discrete map. This identification provided, on the one hand, a reasonable solution algorithm for the fractional kinetic equation in question, and on the other hand a connection to discrete dynamical systems with potentially chaotic dynamics. In every case stochastic webs were identified and attractor basins were found. The detailed results are in the papers, the first published in Physics Letters A, the second in Journal of Physics, A, Math and Theoretical, while the third is under review. The work has been presented at a colloquium at Yeshiva University, and will be presented in the summer of 2010 at the Fourth International Conference 'Frontiers of Nonlinear Physics', Nizhny, Novgorod, Russia (http://www.fnp.sci-nnov.ru/). This work lends itself to substantial future developments.
DTIC
Chaos; Complex Systems; Kinetics

20100019674 Pennsylvania State Univ., University Park, PA USA
Distributed Self-healing Mechanisms for Securing Sensor Networks
Zhu, Sencun; Cao, Guohong; Liu, Peng; Feb 10, 2010; 7 pp.; In English
Contract(s)/Grant(s): W911NF-05-1-0270
Report No.(s): AD-A518946; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518946

The specific goal of this proposal is to design and implement efficient self-healing mechanisms that allow a sensor network to recover from node compromises by itself. To achieve this goal, this proposal describes a self-healing framework that consists of three sequential phases: node compromise detection, node revocation and network reconfiguration, and focuses on designing efficient schemes for each of these phases. It proposes to identify suspicious sensor nodes through time synchronization protocols and location changes of sensor nodes, respectively, in addition to other sources of discovering suspicious nodes. It then investigates techniques to attest the authenticity of the code running in the suspected nodes to check if the suspected nodes are really compromised. Two key updating schemes, one for group key updating and the other for pairwise key updating, are proposed to invalidate the security keys possessed by the nodes that have been identified as compromised.
DTIC
Detectors; Healing

20100019692 Texas Univ., El Paso, TX USA
Interval Mathematics for Analysis of Multiresolutional Systems
Kreinovich, Vladik; Alo, Richard; Sep 2001; 13 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0365
Report No.(s): AD-A518987; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518987

The more complex the problem, the more complex the system necessary for solving this problem. For very complex problems, it is no longer possible to design the corresponding system on a single resolution level, it becomes necessary to have multiresolutional systems. When analyzing such systems - e.g., when estimating their performance and/or their intelligence - it is reasonable to use the multiresolutional character of these systems: first, we analyze the system on the low-resolution level, and then we sharpen the results of the low-resolution analysis by considering higher-resolution representations of the analyzed system. The analysis of the low-resolution level provides us with an approximate value of the desired performance characteristic. In order to make a definite conclusion, we need to know the accuracy of this approximation. In this paper, we describe interval mathematics - a methodology for estimating such accuracy. The resulting interval approach is also extremely

important for tessellating the space of search when searching for optimal control. We overview the corresponding theoretical results, and present several case studies.
DTIC
Image Resolution; Resolution

20100019903 California Univ., Berkeley, CA USA
Geometric Langlands Program and Dualities in Quantum Physics
Frenkel, Edward; Apr 30, 2009; 5 pp.; In English
Contract(s)/Grant(s): FA9550-07-1-0543
Report No.(s): AD-A519424; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Langlands Program was conceived initially as a bridge between Number Theory and Automorphic Representations, but it has now expanded into such areas as Geometry and Quantum Field Theory. Remarkably and surprisingly, the same salient features, such as the Langlands dual group, appear in these different contexts. Understanding the hidden patterns of the Langlands duality may thus hold the key to many important problems in modern mathematics and physics. One of the most exciting developments in this area in the last few years has been the work of Edward Witten and collaborators unifying the Langlands Program with dualities in quantum field theory and string theory. Specifically, they have related the so-called S-duality of the four-dimensional gauge theory to the geometric Langlands correspondence via the dimensional reduction from four to two dimensions. My work on this project continued this line of research as well as other topics on Langlands duality in Representation Theory, Geometry and Quantum Physics.
DTIC
Physics; Quantum Mechanics; Quantum Theory

20100020023 American Univ., Washington, DC USA
A Top Down Theory of Logical Modeling
Shosky, John; Sep 2001; 7 pp.; In English
Report No.(s): AD-A519707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Scientists, logicians, mathematicians, and linguists are among those who employ models. Yet, there are various views of models. For example, Quine has defined models as a sequence of sets and van Fraassen sees them as specific structures, in which all relevant parameters have specific values. Harre argues that they can be either theoretical, as in a set of sentences which can be matched with sentences in which the theory is expressed or iconic, some real or imagined thing, or process, which behaves similarly to some other thing or process, or in some other way than in its behavior is similar to it. The variation in these definitions reflects the many uses of models.
DTIC
Mathematical Logic; Models

20100020223 California Univ., Berkeley, CA USA
Scalable Models Using Model Transformation
Feng, Thomas H; Lee, Edward A; Jul 13, 2008; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-07-2-0019
Report No.(s): AD-A518855; UCB/EECS-2008-85; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518855

Higher-order model composition can be employed as a mechanism for scalable model construction. By creating a description that manipulates model fragments as first-class objects, designers' work of model creation and maintenance can be greatly simplified. In this paper, we present our approach to higher-order model composition based on model transformation. We define basic transformation rules to operate on the graph structures of actor models. The composition of basic transformation rules with heterogeneous models of computation form complex transformation systems, which we use to construct large models. We argue that our approach is more visual than the traditional approaches using textual model descriptions. It also has the advantage of allowing to dynamically modify models and to execute them on the fly. Our arguments are supported by a concrete example of constructing a distributed model of arbitrary size.
DTIC
Computation; Complex Systems; Graphs (Charts)

20100020236 Naval Academy, Annapolis, MD USA
The Reconstruction Conjecture and Edge Ideals
Dalili, Kia; Faridi, Sara; Traves, Will; Jan 2008; 10 pp.; In English
Report No.(s): AD-A519092; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519092

Given a simple graph G on n vertices, we prove that it is possible to reconstruct several algebraic properties of the edge ideal from the deck of G, that is, from the collection of subgraphs obtained by removing a vertex from G. These properties include the Krull dimension, the Hilbert function, and all the graded Betti numbers i,j where j n. We also state many further questions that arise from our study.
DTIC
Algebra; Graph Theory; Apexes

20100020238 Pennsylvania Univ., Philadelphia, PA USA
Quantitative Trust Management: QuanTM, Reputation, and PreSTA
West, Andrew G; Nov 18, 2009; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519215; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519215

TALK OUTLINE: Introducing QTM * QuanTM [1] Model -- TDG: Glue between security and reputation * Fundamentals of Reputation Management * PreSTA [3] Reputation Model __ Partial QTM use-case -- Applicable for fighting spam, Wikipedia * Conclusions.
DTIC
Quantitative Analysis; Cryptography; Cybernetics

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PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20100018389 Fermi National Accelerator Lab., Batavia, IL, USA
Preliminaries Toward Studying Resonant Extraction from the Debuncher
Michelotti, Leo; Johnstone, John; June 30, 2009; 45 pp.; In English
Report No.(s): DE2009-966797; FERMILAB-FN-0842-APC-CD; No Copyright; Avail.: National Technical Information Service (NTIS)

This memo presents considerations preliminary to studying both possibilities. It is meant only as a starting point for investigations to be carried out in the future. The working constraints and assumptions have oscillated between two extremes: (1) making minimal changes in the antiproton source to minimize cost and (2) building another machine in the same tunnel. In this memo we adopt an attitude aligned more toward the first. The assumed parameters are listed in Table 1. A few are not (easily) subject to change, such as those related to the beams momentum and revolution frequency and the acceptance of the debuncher.
NTIS
Antiprotons; Extraction; Particle Accelerators

20100018391 Fermi National Accelerator Lab., Batavia, IL, USA
Equivalence of Inverse Compton Scattering and the Undulator Concept
Ng, K. Y.; August 2009; 16 pp.; In English
Report No.(s): DE2009-966795; No Copyright; Avail.: Department of Energy Information Bridge

Inverse Compton scattering is a method to produce very high frequency photon beam. However, the production mechanism can also be viewed as a undulator emission. This is because the electron sees electric and magnetic fields of the incident laser beam and is driven into transverse oscillatory motion in exactly the same way when the electron passes through a undulator consisting of alternating magnetic field. This note gives a detailed examination of the similarity about the two

views. Equivalent undulator parameters are derived for the incident laser beam, as well as the differential cross section of photon emission.
NTIS
Compton Effect; Electron Scattering; Equivalence; Inverse Scattering; Particle Accelerators; Wiggler Magnets

20100018392 Lawrence Livermore National Lab., Livermore, CA USA
Jack Rabbit Pretest: Shadowplate Drawings for TATB IHE Model Development. Volume 9
Hart, Mark M.; McDaniel, Dennis W.; July 10, 2009; 42 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-966896; LLNL-TR-415545; No Copyright; Avail.: National Technical Information Service (NTIS)

The Jack Rabbit Pretest (PT) series consisted of 5 focused hydrodynamic experiments 2021E PT3, PT4, PT5, PT6, and PT7. They were fired in March and April of 2008 at the Contained Firing Facility, Site 300, Lawrence Livermore National Laboratory, Livermore, California. These experiments measured deadzone formation and impulse gradients created during the detonation of TATB based insensitive high explosive.
NTIS
Detonators; Rabbits; TATB

20100018492 Argonne National Lab., IL, USA
Analysis of Barrel Support Saddles and Forces Between Modules During Assembly
Guarino, V. J.; April 23, 2003; 80 pp.; In English
Contract(s)/Grant(s): DE-AC02-06CH11357
Report No.(s): DE2009-964246; ANL-HEP-TR-07-10; No Copyright; Avail.: National Technical Information Service (NTIS)

As the Barrel Tile Calorimeter is constructed, the support saddles and the modules will be subjected to different forces, stresses, and deflections than when completely assembled. The purpose of this analysis is to examine the forces, stresses, and deflections acting on the support saddles and modules at various stages of assembly. The nominal weight of a barrel module is 20 tons. CERN Document number ATL-LB-EA-0001 'Summary of the Structural Analysis of the Barrel Support Saddles' describes in detail the structural analysis of the saddles and the completed barrel assembly. These calculations followed Eurocode 3. This paper examined several load cases which occur during the assembly of the Barrel. The following are the main conclusions: (1) The assembly is not stable until 18 modules are in place, and only then can the support cradle be removed; (2) The forces between modules are nominal and are far less that the forces in the completed cylinder with 64 modules in place and the cryostat load applied; (3) All of the stresses in the connections between modules are within acceptable limits; and (4) The interface between the cryostat supports and the cryostat move approximately 1.0 mm in the X and Y directions when the load of the cryostat is transferred to the Barrel.
NTIS
Calorimeters; Modules; Particle Accelerators

20100018511 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA; Fermi National Accelerator Lab., Batavia, IL, USA
R and D for a Soft X-Ray Free Electron Laser Facility
Corlett, J.; Attwood, D.; Denes, P.; Falcone, R.; Byrd, J.; June 08, 2009; 60 pp.; In English
Contract(s)/Grant(s): DE-AC02-05CH11231
Report No.(s): DE2009-964409; LBNL-2169E; No Copyright; Avail.: Department of Energy Information Bridge

Several recent reports have identified the scientific requirements for a future soft x-ray light source, and a high-repetition-rate free-electron laser (FEL) facility that is responsive to these requirements is now on the horizon. R&D in some critical areas is needed, however, to demonstrate technical performance, thus reducing technical risks and construction costs. Such a facility most likely will be based on a CW superconducting linear accelerator with beam supplied by a high-brightness, high-repetition-rate photocathode electron gun operating in CW mode, and on an array of FELs to which the accelerated beam is distributed, each operating at high repetition rate and with even pulse spacing. Dependent on experimental requirements, the individual FELs can be configured for either self-amplified spontaneous emission (SASE), seeded, or oscillator mode of operation, including the use of high-gain harmonic generation (HGHG), echo-enhanced harmonic generation (EEHG), harmonic cascade, or other configurations.
NTIS
Free Electron Lasers; Lasers; X Ray Lasers

20100018513 Center for Mathematics and Computer Science, Amsterdam, Netherlands

Convergence and Component Splitting for the Crank-Nicolson/Leap-Frog Integration Method

Verwer, J. G.; February 2009; 16 pp.; In English

Report No.(s): PB2010-107590; MAS-E0902; Copyright; Avail.: National Technical Information Service (NTIS)

A new convergence condition is derived for the Crank-Nicolson/Leap-Frog integration scheme. The convergence condition guarantees second-order temporal convergence uniformly in the spatial grid size for a wide class of implicit-explicit splittings. This is illustrated by successfully applying component splitting to first-order wave equations resulting in such second-order temporal convergence. Component splitting achieves that only on part of the space domain Crank-Nicolson needs to be used. This reduces implicit solution costs when for Leap-Frog the step size is severely limited by stability only on part of the space domain, for example due to spatial coefficients of a strongly varying magnitude or locally refined space grids.

NTIS

Convergence; Eccentrics; Computational Grids; Measure and Integration; Coefficients

20100018607 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Consideration of Wear Rates at High Velocities

Meador, Stephen P; Mar 2010; 136 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517645; AFIT/GAE/ENY/10-M16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517645

The goal of this research is to study sliding contact wear of test sled slippers at high velocities. Experimentation representative of the slippers is infeasible, so numerical studies are used. An Eulerian-Lagrangian hydrocode called CTH is used to study mechanical wear. Failure criteria have been established to evaluate the stresses and strains resulting from the hydrocode simulation of a single asperity collision. The results from the hydrocode simulations are scaled to account for slipper bounce and multiple asperities, and these results produce total wear values that are approximately 90% of total experimental wear. Slipper thermodynamics have also been evaluated. The fraction of frictional heating energy entering the slipper has been evaluated, and an average value of approximately 0.125 has been determined. Total wear for a slipper reaching 3,000 m/s and following a typical slipper velocity profile has been evaluated to range from 3 to 6% of the total slipper volume.

DTIC

High Speed; Sleds; Wear

20100018787 Defence Science and Technology Organisation, Edinburgh, Australia

An Accumulated Damage Model for Blast Propagation in Compartmented Structures with Progressively Failing Thin Bulkheads

Antanovskii, L K; Dec 2009; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518121; DSTO-TR-2365; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518121

This report addresses the development of a model for blast propagation in compartmented structures with progressively failing thin structural elements like windows. The mathematical model is based on the assumption that the frangible structural features (a) are thin compared to the characteristic length scale, (b) do not deform much before breakage, and (c) fail instantaneously when the corresponding accumulated damage reaches some threshold. The presented numerical model employs a variation of the Godunov scheme for blast propagation, coupled with a simple governing equation for the accumulated damage of finite elements constituting a structural feature with empirical coecients estimated from the pressure-impulse diagram. When the accumulated damage exceeds some threshold value, a group of nite elements representing a designated entity like a single window, is forced to fail thus instantaneously changing the computational domain topology. The illustrative numerical simulations in three dimensions demonstrate that the model behaves reasonably well and is capable of providing rough estimates of progressive failure and blast transfer within and between compartmented structures.

DTIC

Accumulations; Bombs (Ordnance); Bulkheads; Damage; Damage Assessment; Impact Damage; Structural Analysis

20100018992 Naval Research Lab., Washington, DC USA

Effects of Magnetism and Doping on the Electron-Phonon Coupling in BaFe2As2

Boeri, L; Calandra, M; Mazin, I I; Dolgov, O V; Mauri, F; Apr 12, 2010; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518640; ARXIV:1004.1943V1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We calculate the effect of local magnetic moments on the electron-phonon coupling in BaFe2As2+ using the density functional perturbation theory. We show that the magnetism enhances the total electron-phonon coupling by approximately 50%, up to lambda smaller or approximate to 0.35, still not enough to explain the high critical temperature, but strong enough to have a non-negligible effect on superconductivity, for instance, by frustrating the coupling with spin fluctuations and inducing order parameter nodes. The enhancement comes mostly from a renormalization of the electron-phonon matrix elements. We also investigate, in the rigid band approximation, the effect of doping, and find that lambda versus doping does not mirror the behavior of the density of states; while the latter decreases upon electron doping, the former does not, and even increases slightly.

DTIC

Additives; Electronic Structure; Electrons; Magnetic Effects; Phonons; Superconductivity

20100019197 Army Research Lab., Aberdeen Proving Ground, MD USA

Real-Time Full-field Deformation Analysis on the Ballistic Impact of Polymeric Materials Using High-speed Photogrammetry

Yu, Jian H; Hsieh, Alex J; Dehmer, Peter G; Sands, James M; Proceedings of the American Society for Composites 2009 (24th); Apr. 2010; 16 pp.; In English; American Society for Composites 2009 (24th) Technical Conference, 15-17 Sep. 2009, Newark, DE, USA; Original contains color illustrations

Report No.(s): AD-A518511; ARL-RP-0290; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The dynamic deformation of transparent polymeric materials during the ballistic impact is investigated using a unique high-speed imaging technique. This technique involves the use of two high-speed cameras to record stereo images of a speckle patterned impact area and subsequent photogrammetric analysis. Photogrammetry is an image correlation technique that determines geometric properties, such as the displacement and strain history of a deformation event, by tracking the minute changes in the speckle pattern on the area of interest. These minute changes are then translated into three-dimensional displacement vectors as a function of time. Important mechanical behavior, such as strain or shear angle, can be calculated from the displacement vectors. By combining high-speed photography with photogrammetry, a full-field view on the strain as a function of time is made possible, and the strain can be resolved into components, such as the principle strain and shear strain. To demonstrate the capability of the high-speed photogrammetric technique, impact measurements on two different polymers were performed. A steel spherical projectile with a diameter of 5.54 mm and a weight of 0.692 g was used to impact a rigid polycarbonate (PC) and a flexible poly(urethane urea) (PUU) elastomer. The measurements were carried out at striking velocities between 100 m/s and 200 m/s, below the ballistic limits of both materials. At low impact speeds, the strain histories revealed that PC had a smaller deformation zone than PUU. At high impact speeds, it was observed that PC suffered a permanent strain deformation, whereas the strain in PUU relaxed over time. From these impact experiments, it is demonstrated that high-speed photogrammetry is able to capture the different strain behavior of these two polymers. These real-time strain histories cannot be easily observed quantitatively by other methods.

DTIC

Ballistic Trajectories; Deformation; High Speed; High Speed Cameras; Impact; Photogrammetry; Plastic Deformation; Real Time Operation; Terminal Ballistics

20100019203 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Investigating the Use of Frequency Selective Surfaces in High Power Microwave Applications

Pugh, Steven; Mar, 2010; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518463; AFIT/GE/ENG/10-25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores new territory with the theoretical investigation of the use of FSS in HPM applications. Work was performed in a simulation environment where rectangular and ring-shaped FSS elements were evaluated. Incident electric field levels of 0.5MV/m were propagated toward the FSS in a plane wave that was perpendicular to the surface. Results show that the total electric field in the apertures of the FSS can reach more than 6MV/m. This necessitates the use of high strength dielectric materials surrounding the FSS to reduce the risk of electrical breakdown. It is shown that a dielectric of only 2.5mm thick on each side of the FSS eliminates the risk of breakdown.

DTIC

Frequencies; Microwaves; Selective Surfaces

20100019394 Minnesota Univ., Minneapolis, MN, USA
Ionic Transport in Electrochemical Media. Final Report
Halley, J. W.; May 20, 2009; 5 pp.; In English
Contract(s)/Grant(s): DE-FG02-93ER14376
Report No.(s): DE2010-952657; DOE/ER/14376-1; No Copyright; Avail.: Department of Energy Information Bridge

This project was a molecular dynamics study of the relevant issues associated with the structure and transport of lithium in polymer electrolytes such as polyethylene oxide(PEO) . In close collaboration with quantum chemist Larry Curtiss and neutron scatterers David Lee Price and Marie-Louise Saboungi at Argonne, we used molecular dynamics to study the local structure and dynamics and ion transport in the polymer. The studies elucidated the mechanism of Li transport in PEO, revealing that the rate limiting step is extremely sensitive to the magnitude of the torsion forces in the backbone of the polymer. Because the torsion forces are difficult to manipulate chemically, this makes it easier to understand why improving the conductivity of PEO based electrolytes has proven to be very difficult. We studied the transport properties of cations in ionic liquids as possible additives to polymer membranes for batteries and fuel cells and found preliminary indications that the transport is enhanced near phase separation in acid-ionic liquid mixtures.
NTIS
Transport Properties; Molecular Dynamics; Lithium; Polyethylenes; Electrolytes

20100019395 Calabazas Creek Research, Inc., San Mateo, CA, USA
Development of a 50 MW 30 GHz Gyroklystron Amplifier
Read, M.; Lawson, W.; Ives, L.; Neilson, J.; May 20, 2009; 18 pp.; In English
Contract(s)/Grant(s): DE-FG02-06ER84454
Report No.(s): DE2010-952611; DOE/ER/84454; No Copyright; Avail.: National Technical Information Service (NTIS)

DOE requires sources for testing of high gradient accelerator structures. A power of 50 MW is required at K and Ka band. The pulse length must be approx. 1 microsecond and the pulse repetition frequency at least 100 Hz. At least some applications may require phase stability not offered by a free running oscillator. CCR proposed to build a 50 MW 30 GHz gyrklystron amplifier. This approach would give the required phase stability. The frequency was at the second harmonic of the cycltron frequency and used the TE02 mode. This makes it possible to design a device without an inner conductor, and with a conventional (non-inverted) MIG. This minimizes cost and the risk due to mechanical alignment issues. A detailed design of the gyroklystron was produced. The design was based on simulations of the cavity(ies), electron gun, output coupler and output window. Two designs were produced. One was at the fundamental of the cyclotron frequency. Simulations predicted an output power of 72 MW with an efficiency of 48%. The other was at the second harmonic, producing 37 MW with an efficiency of 37%.
NTIS
Gyroscopes; Klystrons; Particle Accelerators

20100019396 Calabazas Creek Research, Inc., San Mateo, CA, USA
Over-Moded Fundamental Power Coupler for the ILC. Final Report. Phase I Program
Neilson, J.; Tantawi, S.; Pendleton, R.; May 20, 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-FG02-07ER84911
Report No.(s): DE2010-952609; DOE/ER/84911-F; No Copyright; Avail.: National Technical Information Service (NTIS)

The current designs of fundamental power couplers for the International Linear Collider (ILC) are expensive and require excessively long conditioning times. The goal of this program was development of a new technology for power couplers. This technology is based on the cylindrical TE01 mode and other over-moded technologies developed for the X-band rf distribution system of the NCLTA. During the Phase I program, a TE10 to TE01 mode transducer suitable for use as a part of a power coupler in the ILC was designed and tested at low power.
NTIS
Couplers; Linear Accelerators; Transducers

20100019506 Princeton Univ., NJ, USA
Fundamental Studies of Metastable Liquids. Final Report. (June 1, 1987 through April 30, 2008)
Debenedetti, P. G.; March 09, 2009; 9 pp.; In English
Contract(s)/Grant(s): FG02-87ER13714
Report No.(s): DE2010-948844; DOE/ER-13714-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Materials that exist under thermodynamic conditions in which the stable state is in a different state of aggregation are said

to be metastable. Examples include supercooled liquids (stable state: crystal), superheated liquids (stable state: vapor), and glasses (stable state: crystal). Metastable liquids and glasses play important roles in atmospheric phenomena (cloud formation), communications (optical fibers, which are made of amorphous silica), energy technology (solar cells made of amorphous silicon), and pharmaceutical technology (preservation of labile biochemicals in glassy matrices). In spite of the importance and ubiquity of metastable liquids and glasses, fundamental questions exist on the nature of the glassy state (Is the glass transition kinetic or thermodynamic in nature. What is the microscopic origin of the extraordinary increase in relaxation times that gives rise to the glass transition), and the physical properties of metastable liquids (Does water possess a metastable critical point in the supercooled region. Why do rotational and translational motions decouple in a supercooled liquid). The goal of this project was to investigate the above fundamental questions through the use of molecular simulations and statistical mechanics.
NTIS
Liquids; Metastable State; Supercooling; Proteins; Thermodynamics

20100019523 Center for Mathematics and Computer Science, Amsterdam, Netherlands; Amsterdam Univ., Netherlands
From Coordination to Stochastic Models of QoS
Arbab, F.; Chothia, T.; Van der Mei, R. D.; Meng, S.; Moon, Y. J.; Mar. 2009; 28 pp.; In English
Report No.(s): PB2010-108123; SEN-E0901; Copyright; Avail.: National Technical Information Service (NTIS)

Reo is a channel-based coordination model whose operational semantics is given by Constraint Automata (CA). Quantitative Constraint Automata extend CA (and hence, Reo) with quantitative models to capture such non-functional aspects of a system's behaviour as delays, costs, resource needs and consumption, that depend on the internal details of the system. However, the performance of a system can crucially depend not only on its internal details, but also on how it is used in an environment, as determined for instance by the frequencies and distributions of the arrivals of I/O requests. In this paper we propose Quantitative Intentional Automata (QIA), an extension of CA that allow incorporating the influence of a system's environment on its performance. Moreover, we show the translation of QIA into Continuous-Time Markov Chains (CTMC's), which allows us to apply existing CTMC tools and techniques for performance analysis of QIA and Reo circuits.
NTIS
Automata Theory; Coordination; Stochastic Processes

20100019535 Missouri Univ. of Science and Technology, Rolla, MO, USA
Theoretical Studies of Nucleation Kinetics and Nanodroplet Microstructure
Wilemski, G.; Jan. 2009; 8 pp.; In English
Contract(s)/Grant(s): DE-FG02-98ER14894
Report No.(s): DE2010-946706; DOE/ER/14894-4; No Copyright; Avail.: Department of Energy Information Bridge

The goals of this project were to (1) explore ways of bridging the gap between fundamental molecular nucleation theories and phenomenological approaches based on thermodynamic reasoning, (2) test and improve binary nucleation theory, and (3) provide the theoretical underpinning for a powerful new experimental technique, small angle neutron scattering (SANS) from nanodroplet aerosols, that can probe the compositional structure of nanodroplets. This report summarizes the accomplishments of this project in realizing these goals. Publications supported by this project fall into three general categories: (1) theoretical work on nucleation theory (2) experiments and modeling of nucleation and condensation in supersonic nozzles, and (3) experimental and theoretical work on nanodroplet structure and neutron scattering. These publications are listed and briefly summarized in this report.
NTIS
Aerosols; Kinetics; Microstructure; Nucleation

20100019551 Sandia National Labs., Albuquerque, NM USA
ACME: Algorithms for Contact in a Multiphysics Environment, API Version 2.2
Brown, K. H.; Glass, M. W.; Gullerud, A. S.; Heinstein, M. W.; Jones, R. E.; Jul. 2004; 144 pp.; In English
Contract(s)/Grant(s): AC04-94AL85000
Report No.(s): PB2010-108638; SAND2004-5486; No Copyright; Avail.: CASI: A07, Hardcopy

An effort is underway at Sandia National Laboratories to develop a library of algorithms to search for potential interactions between surfaces represented by analytic and discretized topological entities. This effort is also developing algorithms to determine forces due to these interactions for transient dynamics applications. This document describes the

Application Programming Interface (API) for the ACME (Algorithms for Contact in a Multiphysics Environment) library.
NTIS
Algorithms; Application Programming Interface

20100019729 North Carolina State Univ., Raleigh, NC USA
Novel Non-Volatile Memory Devices Based on Magnetic Semiconductor Nanostructures for Terabit Integration
Kim, Ki Wook; Jan 19, 2010; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-06-1-0267
Report No.(s): AD-A519064; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519064

This research project exploited new spin-dependent phenomena or concepts utilizing the unique properties of graphene for carbon based spintronics as well as more conventional semiconductor based magnetic systems. The primary focus of the effort was on the device concepts utilizing electrical control of the magnetism, which is one of the main advantages of the semiconductor-based magnetic nanostructures over the metallic counterparts. Combined with developments in the materials research, the proposed device concepts could lay the ground for low-power nonvolatile memory and programmable logic elements beyond the current technological limit.
DTIC
Computer Storage Devices; Magnetic Field Configurations; Magnetization; Nanostructures (Devices); Semiconductors (Materials)

20100019754 Nanyang Technological Univ., Nanyang, Singapore
Novel Active Transient Cooling Systems
Ramanujan, Raju V; Keblinski, P; Ramanath, G; Sampathkumaran, E V; May 4, 2010; 14 pp.; In English
Contract(s)/Grant(s): FA2386-08-1-4018
Report No.(s): AD-A519139; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519139

Under this grant, researcher has conducted detailed studies of magnetocaloric nanomaterials for solid state cooling applications. Such materials are of great current interest in solid state cooling. Present work on synthesis, characterization and property evaluation of magnetocaloric materials is summarized. Magnetic refrigeration systems offer good potential to reduce (1) global energy consumption and (2) use of ozone-depleting compounds, greenhouse gases and hazardous chemicals. The experimental investigation of magnetocaloric effects and structural properties of Fe80-xGdxCr8B12 (x = 0, 5, 8, 15) alloys has therefore been studied. Fe80Cr8B12 alloys exhibit good magnetocaloric properties near room temperature. Gd, which is well-known to exhibit good magnetocaloric effects in room temperature, was alloyed in Fe-Cr-B base alloys. The increase of Gd additions displaces the Curie temperature of the alloy to higher temperatures without significant depreciation of entropy change. It is also shown that a phenomenological model which describes the magnetic entropy change is applicable to these alloys.
DTIC
Cooling; Cooling Systems; Energy Conservation; Energy Consumption

20100019867 Naval Academy, Annapolis, MD USA
Vibration Response of an Elastically Point-Supported Plate With Attached Masses
Watkins, R J; Santillan, S; Radice, J; Barton, Jr, O; May 2, 2010; 10 pp.; In English
Report No.(s): AD-A519295; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Experimentally determined natural frequencies and modes shapes are presented for an elastically point-supported isotropic plate with attached masses under impulsive loading. These results are compared to frequencies and to modes shapes determined from the Rayleigh-Ritz method and a finite element analysis using COMSOL. Accelerometers mounted at three locations on the plate, provide input for ME'Scope Modal Analysis Software to identify frequency peaks and modes shapes. Orthogonal polynomials, which meet free-free plate boundary conditions, are selected as the basis functions used in the Rayleigh-Ritz method. A Mindlin plate theory, adjusted for negligible transverse shear effects, is used in COMSOL. Frequencies and mode shapes for four plate configurations are presented, compared using each method, and indicate good agreement between the numerical, analytical and experimental results.
DTIC
Bending Fatigue; Vibration

20100019947 Coast Guard, Washington, DC USA
Coast Guard Spectrum Management (CG-652)
Blackmore, Ronald; Mar 2010; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519511; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Briefing on the organization and points of contact for Coast Guard Spectrum Management. Contact information is included for all POC.

DTIC
Coasts; Frequency Assignment; Spectra

20100020030 Rice Univ., Houston, TX USA
Compressive Sensing for Background Subtraction
Cevher, Volkan; Sankaranarayanan, Aswin; Duarte, Marco F; Reddy, Dikpal; Baraniuk, Richard G; Chellappa, Rama; Dec 20, 2009; 16 pp.; In English
Contract(s)/Grant(s): W911NF-07-1-0185; W911NF-07-1-0502
Report No.(s): AD-A519730; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Compressive sensing (CS) is an emerging field that provides a framework for image recovery using sub-Nyquist sampling rates. The CS theory shows that a signal can be reconstructed from a small set of random projections, provided that the signal is sparse in some basis, e.g., wavelets. In this paper, we describe a method to directly recover background subtracted images using CS and discuss its applications in some communication constrained multi-camera computer vision problems. We show how to apply the CS theory to recover object silhouettes (binary background subtracted images) when the objects of interest occupy a small portion of the camera view, i.e., when they are sparse in the spatial domain. We cast the background subtraction as a sparse approximation problem and provide different solutions based on convex optimization and total variation. In our method, as opposed to learning the background, we learn and adapt a low dimensional compressed representation of it, which is sufficient to determine spatial innovations; object silhouettes are then estimated directly using the compressive samples without any auxiliary image reconstruction. We also discuss simultaneous appearance recovery of the objects using compressive measurements. In this case, we show that it may be necessary to reconstruct one auxiliary image. To demonstrate the performance of the proposed algorithm, we provide results on data captured using a compressive single-pixel camera. We also illustrate that our approach is suitable for image coding in communication constrained problems by using data captured by multiple conventional cameras to provide 2D tracking and 3D shape reconstruction results with compressive measurements.

DTIC
Compressibility; Detection; Image Reconstruction

20100020032 Rice Univ., Houston, TX USA
Compressive Domain Interference Cancellation
Davenport, Mark A; Boufounos, Petros T; Baraniuk, Richard G; Jan 2009; 8 pp.; In English
Contract(s)/Grant(s): W911NF-07-1-0185
Report No.(s): AD-A519734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we consider the scenario where a compressive sensing system acquires a signal of interest corrupted by an interfering signal. Under mild sparsity and orthogonality conditions on the signal and interference, we demonstrate that it is possible to efficiently filter out the interference from the compressive measurements in a manner that preserves our ability to recover the signal of interest. Specifically, we develop a filtering method that nulls out the interference while maintaining the restricted isometry property (RIP) on the set of potential signals of interest. The construction operates completely in the compressive domain and has computational complexity that is polynomial in the number of measurements.

DTIC
Cancellation; Compressibility

20100020141 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Polarizabilites and Rydberg States in the Presence of a Debye Potential
Bhatia, A. K.; Drachman, Richard J.; Bulletin of the American Physical Society; May 25, 2010; Volume 55, No. 5; 1 pp.; In English; Division of Atomic, Molecular and Optical Physics, 25-29 May 2010, Miami, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

Polarizabilities and hyperpolarizabilities, alpha(1), beta(1),gamma(1), alpha(2), beta(2),gamma(2), alpha(3),

beta(3),gamma(3), delta and epsilon of hydrogenic systems have been calculated by Drachman. We have now calculated these quantities by using pseudostates for the S. P. D and F states. All of them converge very fast as the number of terms in the pseudostates is increased, and are essentially independent of the nonlinear parameters. All the results are in good agreement with the results obtained by Drachman. except for delta, which is of the third-order in perturbation formalism. We have calculated Rydberg states of He for high N and L. The effective potential is -alpha(sub 1)/x(exp 4)+{6 * Beta(sub 1) -alpha(sub 2)/x(exp6), where x is the distance of the outer electron from the nucleus. The exchange and electron-electron correlations are unimportant because the outer electron is far away from the nucleus. This implies that the conventional variational calculations are not necessary. The results agree well with the results of Drachman. We have generalized this approach in the presence of a Debye potential.
Author
Formalism; Polarization Characteristics; Rydberg Series

20100020189 Defense Business Board, Washington, DC USA; Defense Business Board, Washington, DC USA
A Review of Spectrum Management
January 2010; 40 pp.; In English
Report No.(s): AD-A518951; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518951

Over the last several decades the Department of Defense (DoD) has increasingly relied upon the availability of radio frequency (RF) spectrum in order to conduct modern warfare. At the same time, there has been a dramatic increase in demand from the commercial sector for the use of the same frequencies and in the same geographies that are critical to the DoD. This is complicated even further as Administrations, including the current one, are making more RF spectrum available for auction in order to provide broadband and mobile capacity to the commercial sector for civilian use - and generate revenues to reduce the deficit. These efforts, combined with pending legislation that could mandate a full inventory of federal spectrum use (including classified use), are resulting in the need for DoD to increase the efficient utilization of the available spectrum in the near term and develop a sound forward-looking strategy for future use of spectrum. The Defense Business Board (DBB) was asked to review DoD's policies in this area and a copy of the official Terms of Reference (TOR) may be found in Appendix A.
DTIC
Radio Frequencies; Spectra

20100020285 Air Force Research Lab., Wright-Patterson AFB, OH USA; Kansas Univ., Lawrence, KS, USA
Microstructural Characterization of YBa2Cu3O7-x Films with BaZrO3 Nanorods Grown on Vicinal SrTiO3 Substrates (Postprint)
Baca, F. Javier; Haugan, Timothy J.; Reichart, Joshua; Barnes, Paul N.; Emergo, Rose Lyn; Wu, Judy Z.; March 2010; 6 pp.; In English
Contract(s)/Grant(s): Proj-3145; 62203F
Report No.(s): AD-A519632; AFRL-RZ-WP-TP-2010-2082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

When grown on miscut SrTiO3 substrates, significant microstructural changes are observed in BaZrO3-doped YBa2Cu3O7-x thin films when compared to those on non-vicinal substrates. Scanning Electron Microscopy indicates a surface morphology strongly influenced by the vicinal angle, and an accumulation of BaZrO3 particles is observed near the step edges. Cross-sectional Transmission Electron Microscopy reveals that while the columnar formations of BaZrO3 rods typically seen on non-vicinal substrates are present, a significant increase in planar defects in a 10 vicinal film are observed. The effects observed with increasing miscut angle indicate that the modulated surface provided by the vicinal substrate influences the crystalline quality of the YBCO matrix and BZO columnar formation through the thickness of the film.
DTIC
Barium Zirconates; Microstructure; Nanorods; Strontium Titanates; Substrates; Thin Films; YBCO Superconductors

20100020290 Colorado Univ., Boulder, CO USA

Toward a Rayleigh Wave Attenuation Model for Central Asia and Surrounding Regions

Levshin, Anatoli L.; Barmin, Mikhail P.; Yang, Xiaoning; Ritzwoller, Michael H.; Randall, George E.; Proceedings of the 29th Monitoring Research Review: Ground Based Nuclear Explosion Monitoring Technologies; September 2007, pp. 111-122; In English; 29th Monitoring Research Review: Ground Based Nuclear Explosion Monitoring Technologies, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-FC52-05NA26608; DE-AC52-06NA25396

Report No.(s): AD-A519487; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on progress toward an attenuation model for short-period (10-20 s) Rayleigh waves in Central Asia and surrounding regions. This model will be defined by maps of attenuation across the region of study in the specified period band. The model is designed to calibrate the regional surface-wave magnitude scale and to extend the teleseismic 'surface-wave magnitude-body-wave magnitude' (Ms-mb) discriminant to regional distances (Marshall and Basham, 1971; Bonner et al., 2006; Russell, 2006). Work is progressing in three stages: (1) data accumulation and amplitude measurements, (2) estimation of attenuation coefficients, and (3) tomographic inversion of attenuation data. The first stage in model construction was the measurement of Rayleigh wave spectral amplitudes. To overcome inherent difficulties due to multipathing and scattering of short-period surface waves we applied the Surface Wave Amplitude Measurement Tool (SWAMTOOL) designed at Los Alamos National Laboratory (LANL) (Yang et al., 2005), which incorporates dispersion analysis, phase-matched filtering, and additional means to estimate the quality and reliability of the measurements. We enhanced SWAMTOOL by providing different options for phase-matched filtering of surface wave signals (Levshin et al., 2006). We collected and processed waveform data for 200 earthquakes occurring throughout 2003-2006 inside and around Eurasia. The records of about 140 broadband permanent and temporary stations were used. The existing broadband station distribution and the pattern of seismicity provided sufficient number of spectral amplitude measurements between 12 and 20 s periods for the construction of the two-dimensional (2-D) tomographic maps of attenuation coefficients. Measurements at periods below about 12 s are too scarce for tomographic inversion.

DTIC

Asia; Rayleigh Waves; Wave Attenuation

20100020309 California Univ., Santa Cruz, CA USA; Los Alamos National Lab., NM, USA

Development of Regional Phase Tomographic Attenuation Models for Eurasia

Lay, Thorne; Xie, Xiao-Bi; Yang, Xiaoning (David); Arrowsmith, Marie D.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007, pp. 100-110; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA

Contract(s)/Grant(s): DE-FC52-05NA26606; DE-AC52-06NA25396

Report No.(s): AD-A519674; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are developing regional-phase (Pn, Pg, Sn, Lg) tomographic attenuation models for Eurasia. The models will be integrated into the National Nuclear Security Administration (NNSA) Knowledge Base and used in the Magnitude and Distance Amplitude Correction (MDAC) station calibration for the development of regional seismic discriminants. Our current focus is on Pn, an extremely important phase in seismic event identification. Accurately accounting for regional-phase geometric spreading is critical for the development of useful attenuation models. It is particularly important for Pn and Sn waves because the propagation mode of these waves makes them more susceptible to upper mantle velocity structures and the Earth's sphericity, which in turn causes the geometric spreading of Pn (and Sn) to be dependent on frequency as well as on range in a complicated way. We conduct numerical simulations to quantify Pn and Sn geometric spreading in a spherical Earth model with constant mantle velocities.

DTIC

Asia; Attenuation; Europe; Tomography

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20100018484 NASA Glenn Research Center, Cleveland, OH, USA
Acoustic Performance of Novel Fan Noise Reduction Technologies for a High Bypass Model Turbofan at Simulated Flights Conditions
Elliott, David M.; Woodward, Richard P.; Podboy, Gary G.; April 2010; 27 pp.; In English; 15th Aeroacoustics Conference, 11-13 May 2009, Miami, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.18.02
Report No.(s): NASA/TM-2010-215841; AIAA Paper 2009-3140; E-17102; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018484

Two novel fan noise reduction technologies, over the rotor acoustic treatment and soft stator vane technologies, were tested in an ultra-high bypass ratio turbofan model in the NASA Glenn Research Center s 9- by 15-Foot Low-Speed Wind Tunnel. The performance of these technologies was compared to that of the baseline fan configuration, which did not have these technologies. Sideline acoustic data and hot film flow data were acquired and are used to determine the effectiveness of the various treatments. The material used for the over the rotor treatment was foam metal and two different types were used. The soft stator vanes had several internal cavities tuned to target certain frequencies. In order to accommodate the cavities it was necessary to use a cut-on stator to demonstrate the soft vane concept.
Author
Acoustic Properties; Aerodynamic Noise; Turbofans; Noise Reduction; Bypass Ratio

20100018616 Naval Oceanographic Office, Bay Saint Louis, MS USA
Ambient Noise Classification in the Gulf of Mexico
Snyder, Mark A; Orlin, Peter A; Oct 2007; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517701; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517701

Long-term omni-directional ambient noise was collected in the Gulf of Mexico during 2004 and 2005. The data were recorded continuously and have a bandwidth of 10-1000 Hz. Two-minute averages of Short Time Fourier Transforms (STFT) of the data were computed. The processed data contain wind and wave noise, distant shipping, nearby shipping and storm passage noise with amplitude variation spanning multiple time scales. These contributions to the overall noise level are additive in producing the total measured noise level at any time. An heuristic scheme based on determining the local mean noise level over a period of several hours is used to determine the positive and negative peak values of the data relative to the local mean. The statistics of the negative peaks are used to eliminate large positive peaks (outliers) resulting from nearby shipping. The final local mean is used to characterize long period processes resulting from frontal passages or storms. The removed peak data are used to characterize shipping, and the data with the peaks removed are used to characterize long period ambient noise from wind, waves and precipitation about the local mean. The results of the analysis of the data from January 2005 will be presented.
DTIC
Ambience; Classifications; Gulf of Mexico; Noise (Sound); Underwater Acoustics

20100018674 Naval Research Lab., Washington, DC USA
Fiber Optic Towed Arrays
Kirkendall, C; Barock, T; Tveten, A; Dandridge, A; Jan 2007; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517838; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517838

The current effort to bring the fiber optic towed array to production (designated the TB-33) is a joint effort involving Naval Undersea Warfare Center (NUWC), Chesapeake Sciences Corporation, General Dynamics, and NRL. NRL has played a critical role in developing the hydrophone design for this array and the interrogation/multiplexing approach used in the system. Unlike the AOTA demonstration and the Navy's fiber optic LightWeight Wide Aperture Array (currently in production), which are coupler-based systems, the TB-33 array uses low-reflectivity fiber Bragg gratings written in the fiber to define the sensors by forming low-reflectivity Fabry-Perot interferometers. The hydrophones are passively multiplexed both in time and in wavelength to allow hundreds of channels to be carried over just four optical fibers. This architecture is ideally suited to the

towed array -- it minimizes the number of optical components in the array, which is critical to minimizing the diameter of the hydrophone core, and in turn allows a thicker hose wall to be used, thus increasing the durability and reliability of the array.
DTIC
Acoustics; Fiber Optics; Hydrophones; Signal Detectors

20100018718 Naval Research Lab., Bay Saint Louis, MS USA
Characterization of the Range Dependence of an Ocean Environment to Reduce Acoustic Estimation Time
Dennis, Steven M; Fabre, J P; Jan 2007; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517964; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517964

As computer capabilities continue to increase, characterization of the oceanic environment improves both spatially and temporally. This oceanographic information (specifically sound velocity) is often used to make acoustic predictions, but wide-area acoustic predictions have been limited by computation time. Currently, in order to characterize an area acoustically, propagation loss estimates are computed for equally spaced grid points over a large area. Acoustic models have become fairly fast, however, when doing multiple source and receiver configurations, multiple frequencies and several range dependent bearings for many grid points, the task can become computationally prohibitive. Range independent predictions are significantly faster than range dependent predictions, but can under-represent the acoustic propagation due to features in the sound speed structure where the environment is non-adiabatic (range dependent). Adiabatic normal mode calculations can also be done fairly quickly (faster than range independent transmission loss predictions) but for the same reason, still do not provide the best estimate of the acoustics. A method is developed and presented here to compute normal modes for an environment and use them to determine how adiabatic that environment is. This is done by comparing the number of modes and the wave numbers computed for each sound speed profile, to those of neighboring profiles. If the nature of the mode functions changes significantly, the profile is flagged as non-adiabatic. Once the adiabatic determination is made, range dependent runs are computed for the areas that are shown to be non-adiabatic and range independent runs are computed for the adiabatic areas. This process reduces the amount of run time required to assess an area, while maintaining a high level of accuracy of the acoustic characterization of the whole area.
DTIC
Acoustics; Estimates; Marine Environments

20100018732 Naval Research Lab., Washington, DC USA
Remote Intense Laser Acoustic Source
Jones, T G; Ting, A; Penano, J; Sprangle, P; Bibee, L D; Jan 2007; 4 pp.; In English
Report No.(s): AD-A517998; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517998

NRL is developing a novel underwater acoustic source, in which a tailored intense broadband laser pulse propagates many meters underwater and generates an acoustic pulse at a predetermined remote location. Such a new acoustic source could enable or improve several critical Navy and commercial applications, including acoustic imaging, undersea communications, and navigation. As part of this work we are exploring intense laser propagation physics through both air and water. Air propagation of the laser pulse will be useful for applications where airborne lasers generate underwater acoustic signals. Controlled underwater compression of these optical pulses is achieved using a combination of group velocity dispersion (GVD), which provides longitudinal compression, and nonlinear self-focusing (NSF), which provides transverse compression. The resulting high-intensity laser pulse then causes photoionization, intense localized heating, and shock generation. Recent experiments included the first demonstration of underwater acoustic generation using an intense broadband laser pulse. Intense acoustic source levels were measured, and are in the range of useful levels for some Navy applications. Optical GVD was precisely measured, and characterization of this acoustic source, including power spectrum and radiation pattern, is under way.
DTIC
Laser Outputs; Sound Generators; Underwater Acoustics

20100018743 Missouri Univ., Rolla, MO USA

Frequency-Domain Channel Estimation and Equalization for Single Carrier Underwater Acoustic Communications

Zheng, Yahong R; Xiao, Chengshan; Yang, T C; Yang, Wen-Bin; Jan 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-1-0219; NSF-CCF-0514770

Report No.(s): AD-A518020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518020

A new frequency-domain channel estimation and equalization (FDE) scheme is proposed for single carrier (SC) underwater acoustic communications. The proposed SC-FDE employs a small training signal block for initial channel estimation in the frequency domain and converts the estimated transfer function to a desired DFT (discrete Fourier transform) size for channel equalization of the data blocks. The frequency domain equalizer is designed using the linear minimum mean square error criterion. A new phase coherent detection scheme is also proposed and deployed to combat the phase drift due to the instantaneous Doppler in the underwater channels. The channel transfer functions and group-averaged phase drift are re-estimated adaptively in a decision-directed manner for each data block in a packet, which contains M blocks of QPSK data. The proposed SC-FDE method is applied to single input multiple output (SIMO) systems using the experimental data measured off the coast of Panama City, Florida, USA, June 2007. The uncoded bit error rate of the SIMO systems varies between 1.3% to 6.8 10(-5) when 4 tilde 8 receive hydrophones are utilized, and the source-receiver range is 5.06 km.
DTIC

Acoustics; Communication; Frequencies; Sound Transmission; Underwater Acoustics

20100018773 Naval Research Lab., Washington, DC USA

Environmental Acoustic Variability Characterization for Adaptive Sampling

Fabre, J P; Rowley, C; Jacobs, G; Coelho, E; Bishop, C; Hong, X; Cummings, J; Jan 2008; 5 pp.; In English

Report No.(s): AD-A518086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518086

During shallow water antisubmarine warfare missions, environmental uncertainty significantly impacts Fleet asset performance. Oceanographic sensor availability, acoustic sensor coverage, and operational time limitations put constraints on efforts to observe large ocean areas. To address these challenges, NRL researchers have advanced and incorporated applied research technologies developed under several disciplines to implement an adaptive sensor placement capability that, under certain assumptions, minimizes the uncertainty in forecasted information. The technologies incorporated include ocean data quality control, rapidly nested oceanographic modeling, data assimilation, ensemble representation of uncertainty, acoustic performance modeling, and Ensemble Transform Kalman Filter (ETKF) adaptive sampling.
DTIC

Acoustic Properties; Acoustics; Adaptation; Characterization; Marine Environments; Sampling; Signal Detectors; Variability

20100018807 Naval Research Lab., Bay Saint Louis, MS USA

Broadband Acoustic Transmission Measurements in Surface Ship Wakes

Stanic, Steve; Kennedy, Edgar; Brown, Bob; Malley, Dexter; Goodman, Ralph; Caruthers, Jerauld; Sep 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518197

Since the time of World War II the propagation of sound in ship wakes has been subject of considerable interest. A ship's wake is a mixture of turbulent seawater created by the motion of a surface ship's hull and air bubbles that are created by the breaking of a ship's bow and stern waves, and by the cavitation of the ship's propellers. The signature of a ship's wake will vary, depending primarily on hull design, speed through the water, and local oceanographic conditions. As the wake ages, it goes from a violent breakup and mixing of bubbles due to turbulent diffusion, to one where the turbulence decays and the bubbles begin to rise slowly toward the surface due to their buoyancy and changes in the buoyancy of the water mass. This time and frequency dependent bubbly mixture has dramatic effects on acoustic signals due to increases in absorption and refraction. As the wake ages, bubbles of different sizes rise at different rates, and the horizontal and vertical distributions of bubble densities give rise to changes in both sound speed and absorption. It is these generated bubble densities that create large acoustic resonance scattering cross sections that are responsible for the acoustic signature of a ship's wake. In this paper, we will describe a method of measuring the average across the wake excess absorption due to bubbles within the wake. Pulsed cw signals ranging from 30 kHz to 140 kHz, in 10 kHz increments, were transmitted across a surface ship wake. Using the average excess signal absorption at 12 frequencies and, and their resonance frequencies, estimates of bubble number densities

as a function of wake age were obtained at 7.4-meter increments behind the wake generating ship. These measurements were continued for about 2 km behind the ship.
DTIC
Acoustic Measurement; Acoustic Propagation; Broadband; Bubbles; Ships; Sound Transmission; Wakes

20100018816 Naval Undersea Warfare Center, Newport, RI USA
Sensor Repositioning to Improve Undersea Sensor Field Coverage
Kone, Zie; Rowe, Errol G; Wettergren, Thomas A; Sep 2007; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518215; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518215

The growing demand for persistent underwater surveillance has led to a need to increase reliance on undersea distributed sensor networks for undersea target detection, classification and tracking. While tremendous progress has been made in the technology of small, relatively inexpensive sensors over the last decade, progress has lagged in the areas of sensor allocation and sensor management. How best to deploy and reposition sensors and small unmanned vehicles (movable sensors) are important research questions that must be addressed to realize the intended use of these technologies. This paper addresses various issues relating to repositioning of sensors in order to improve the coverage of the distributed sensor network. In addition to more traditional assignment algorithms, which minimize the total (equivalently, average) cost for moving all sensors, we consider various cost-based assignment techniques that aim to minimize maximal displacement. We argue that for some scenarios, especially small to moderate networks of sensors with limited fuel supply, the minimization of the maximal displacement is preferable to the solution of the more traditional assignment algorithm. The latter often produces results with relatively large costs for at least some of its assignments. This leads to diminished effectiveness over time for the sensor field. Since fuel supply is limited for these unmanned vehicles, we consider assignment procedures that will not deplete the vehicles' resources during the maneuvering phase. Finally, we compare the performance of several algorithms used to minimize the maximal cost associated with repositioning a field of movable sensors.
DTIC
Algorithms; Networks; Surveillance; Underwater Vehicles

20100018879 Maine Univ., Orono, ME USA
Optics, Acoustics, and Stress in a Nearshore Bottom Nepheloid Layer
Boss, Emmanuel; Hill, Paul S; Milligan, Timothy G; Trowbridge, John H; Jan 2008; 9 pp.; In English
Contract(s)/Grant(s): N00014-04-1-0235
Report No.(s): AD-A518118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research is to develop greater understanding of the how the flocculation of fine-grained sediment responds to turbulent stresses and how this packaging of sediment affects optical and acoustical properties in the water column. Objectives are to: 1. Quantify the effects of aggregation dynamics on the size distribution of particles in the bottom boundary layer; 2. Quantify how changes in particle packaging affect the optical and acoustical properties of the water column. 3. Develop models describing the associations between particle aggregation, stress, and the acoustical and optical fields.The approach is to obtain measurements that will permit comparisons of the optical and acoustical signatures of suspended particles and inferences of the particle size distribution and its temporal evolution, concurrently with fluid dynamical measurements that determine the flow field within which the particles evolve. The instrumentation is mounted on bottom tripods and includes a 9-wavelength optical attenuation and absorption meter (WetLabs ac-9, with automated regular dissolved measurement for calibration independent particulate measurements), a LISST-100 laser diffraction particle sizer (Agrawal & Pottsmith 2000), a digital floc camera (DFC) (Curran et al. 2002b), a Tracor Acoustic Profiling System (TAPS, Holliday 1987), and an array of SonTek/YSI acoustic Doppler velocimeters (ADVs). Near-simultaneous measurements with and without a filter assure high-quality particulate spectral absorption and attenuation measurements with the ac-9. The LISST-100 and floc camera together provide particulate size distributions from 2.5 micrometers to 1 centimeter. The TAPS obtains range-gated, vertical profiles of acoustical backscatter intensity at a range of frequencies between 0.3 and 3.0 MHz. The TAPS and ADVs produce acoustical measurements over a wide range of frequencies that can be used to generate particle size distributions (Holliday, 1987; Hay and Sheng, 1992).
DTIC
Acoustic Properties; Acoustics; Particle Size Distribution; Sediments; Shear Stress; Signatures

20100018895 Stanford Univ., Stanford, CA USA

Physical Mechanisms Underlying Ultrasonic Non-Destructive Evaluation of Fatigue

Cai, Wei; Apr 7, 2010; 6 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0464

Report No.(s): AD-A518367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have established Dislocation Dynamics (DD) simulations as a practical method to compute the acoustic nonlinearlity parameter, beta, which forms the bases of the emerging metal fatigue detection technique of nonlinear ultrasonics. Our study have uncovered mistakes in two well-known theoretical models in this field and leads to a deeper understanding of the dislocation mechanism to acoustic nonlinearity. For a single dislocation bowing in its glide plane between two pinning points (i.e. the monopole model), our simulations and analytic derivations show a strong dependence of beta on the dislocation orientation, which is missed by the previous model (Hikata et al. 1965). For parallel dislocations forming a multipole configuration (as a model for the vein structure in fatigued metal), our simulations show a pronounced dependence of beta on the applied stress (with beta=0 at zero stress), which contradicts the previous model that predicts a constant beta independent of stress (Cantrell et al. 2001). Our analytic derivations have pinpointed the mistake in the previous model.

DTIC

Nondestructive Tests; Ultrasonics

20100018937 Naval Research Lab., Washington, DC USA

Modeling Reverberation Time Series for Shallow Water Clutter Environments

LePage, K D; Jan 2007; 6 pp.; In English

Report No.(s): AD-A518487; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The phenomenon of clutter in shallow water environments can be modeled from several approaches. One approach we have taken is to model reverberation time series for heterogeneous environments with a variety of scattering mechanisms to compare the resulting characteristics to those of experimentally observed clutter. Here we show R-SNAP reverberation time series estimates for the Malta Plateau region in the Straits of Sicily that seem to capture some of the clutter behavior observed during the SCARAB 98 experiment conducted in conjunction with the NATO Undersea Research Centre (NURC), Italy. Of particular interest is the appearance of coherent time-frequency striation patterns in both the modeled and observed reverberation, with spatially compact, broadband clutter features superimposed by the presence of environmental discontinuities.

DTIC

Clutter; Malta; Plateaus; Reverberation; Shallow Water; Time Series Analysis

20100018965 Naval Postgraduate School, Monterey, CA USA

Fine-Scale Variability in Temperature, Salinity, and pH in the Upper-Ocean and the Effects on Acoustic Transmission Loss in the Western Arctic Ocean

Col, Stephen M; Mar 2010; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518578; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Acoustic propagation in the ocean is dependent on the sound speed profile, which is a function of temperature, salinity, and pressure. In the upper ocean, these variables can change quickly as a result of fronts, internal waves, diurnal heating and other mechanisms. Transmission loss (TL) is a function of geometrical spreading, absorption, and scattering. Absorption is a function of temperature, salinity, pressure, and pH. pH variability is typically omitted from TL calculations. This thesis studied the effects of variability in the vertical structure of temperature, salinity and pH on acoustic TL in the Arctic Ocean. These parameters were measured in the Beaufort Sea in March 2009 during ICEX2009 over a period of 15 days. Frequencies considered in this study were 100Hz, 1kHz, and 10kHz. This range of frequencies brackets the boric acid relaxation frequency and is of interest to the U.S. Navy for anti-submarine warfare. Expected absorption losses were estimated by integrating the loss over individual ray paths. Calculations were performed with constant pH as well as by using the measured depth dependent pH. The resulting difference in total absorption losses computed with constant versus variable pH was less than 2dB over a 50km distance. The error in transmission loss calculations due to ignoring pH variability is expected to be very small compared to the uncertainties due to ice scatter-absorption. Therefore, routine measurements of the depth dependent pH levels are not recommended for the purpose of transmission loss calculations under Arctic ice cover.

DTIC

Acoustic Propagation; Arctic Ocean; Oceans; pH; Salinity; Sound Transmission; Transmission Loss; Variability

20100019025 BAE Systems, Nashua, NH USA

Differential Frequency Hopping (DFH) Modulation for Underwater Acoustic Communications and Networking

Edelson, Geoffrey S; Egnor, Dianne E; Apr 19, 2010; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-C-0306

Report No.(s): AD-A518717; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary technical objective of this effort is to realize theoretical DFH performance in the doubly spread underwater acoustic channel. To do so, we need to develop demodulation schemes that are robust to various aspects of the environment. Variations in water depth, bottom type, sound speed profile, and source/receiver location call provide for wide ranges of multi-path interference (resulting in time spread). Different wind and surface wave conditions in combination with platform motion can result in varying degrees of Doppler spreading. The developed algorithms must work well across the range of conditions that will be encountered in real-life scenarios. Within the doubly-spread underwater acoustic channel, we wish to increase throughput without penalty to the inherent interference and collision tolerant properties of the waveform. This includes channel access by multiple users sharing the same frequency band (and even the same hop set) and the same time interval.

DTIC

Acoustics; Communication; Frequency Hopping; Frequency Shift; Modulation; Sound Transmission; Underwater Acoustics; Underwater Communication

20100019158 NASA Langley Research Center, Hampton, VA, USA

Human Response to Low-Intensity Sonic Booms Heard Indoors and Outdoors

Sullivan, Brenda M.; Klos, Jacob; Buehrle, Ralph D.; McCurdy, David A.; Haering, Edward A., Jr.; April 2010; 43 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.07.18.03

Report No.(s): NASA/TM-2010-216685; L-19846; NF1676L-10465; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019158

Test subjects seated inside and outside a house were exposed to low-intensity N-wave sonic booms during a 3-week test period in June 2006- The house was instrumented to measure the booms both inside and out. F-18 aircraft were flown to achieve a variety of boom overpressures from approximately .1 to .6 psf During four test days, seventy-seven test subjects heard the booms while seated inside and outside the house. Using the Magnitude Estimation methodology and artificial reference sounds ; the subjects rated the annoyance of the booms. Since the same subjects heard similar booms both inside and outside the house, comparative ratings of indoor and outdoor annoyance were obtained. For a given metric level, indoor subjects gave higher annoyance scores than outdoor subjects. For a given boom; annoyance scores inside were on average the same as those outside. In a post-test questionnaire, the majority of subjects rated the indoor booms as more annoying than the outdoor ones. These results are discussed in this paper.

Author

Human Reactions; Sonic Booms; F-18 Aircraft; Ratings

20100019161 NASA Langley Research Center, Hampton, VA, USA

A Parameter Identification Method for Helicopter Noise Source Identification and Physics-Based Semi-Empirical Modeling

Greenwood, Eric, II; Schmitz, Fredric H.; May 11, 2010; 16 pp.; In English; AHS International 66th Annual Forum and Technology Display, 11-13 May 2010, Phoenix, AZ, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.07.04.02

Report No.(s): NF1676L-9562; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019161

A new physics-based parameter identification method for rotor harmonic noise sources is developed using an acoustic inverse simulation technique. This new method allows for the identification of individual rotor harmonic noise sources and allows them to be characterized in terms of their individual non-dimensional governing parameters. This new method is applied to both wind tunnel measurements and ground noise measurements of two-bladed rotors. The method is shown to match the parametric trends of main rotor Blade-Vortex Interaction (BVI) noise, allowing accurate estimates of BVI noise to be made for operating conditions based on a small number of measurements taken at different operating conditions.

Author

Acoustic Simulation; Aerodynamic Noise; Aircraft Noise; Blade Slap Noise; Rotor Aerodynamics; Parameter Identification; Noise Measurement; Noise Generators; Interactional Aerodynamics; Helicopters

20100019189 Catholic Univ. of America, Washington, DC USA

Outdoor Synthetic Aperture Acoustic Ground Target Measurements

Bishop, Steven; Ngaya, Therese-Ann; Vignola, Joe; Judge, John; Marble, Jay; Gugino, Pete; Sournekh, Mehrdad; Rosen, Erik; Apr. 19, 2010; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-07-R-0003-02

Report No.(s): AD-A518719; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A novel outdoor synthetic aperture acoustic (SAA) system consists of a microphone and loudspeaker traveling along a 6.3-meter rail system. This is an extension from a prior indoor laboratory measurement system in which selected targets were insonified while suspended in air. Here, the loudspeaker and microphone are aimed perpendicular to their direction of travel along the rail. The area next to the rail is insonified and the microphone records the reflected acoustic signal, while the travel of the transceiver along the rail creates a synthetic aperture allowing imaging of the scene. Ground surfaces consisted of weathered asphalt and short grass. Several surface-laid objects were arranged on the ground for SAA imaging. These included rocks, concrete masonry blocks, grout covered foam blocks; foliage obscured objects and several spherical canonical targets such as a bowling ball, and plastic and metal spheres. The measured data are processed and ground targets are further analyzed for characteristics and features amenable for discrimination. This paper includes a description of the measurement system, target descriptions, synthetic aperture processing approach and preliminary findings with respect to ground surface and target characteristics.

DTIC

Acoustic Measurement; Sonar; Synthetic Apertures; Targets

20100019317 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development and Evaluation of a Multistatic Ultrawideband Random Noise Radar

Nelms, Matthew E.; March 2010; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518452; AFIT/GE/ENG/10-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research studies the AFIT noise network (NoNET) radar node design and the feasibility in processing the bistatic channel information of a cluster of widely distributed noise radar nodes. A system characterization is used to predict theoretical localization performance metrics. Design and integration of a distributed and central signal and data processing architecture enables the Matlabr-driven signal data acquisition, digital processing and multi-sensor image fusion. Experimental evaluation of the monostatic localization performance reveals its range measurement error standard deviation is 4.8 cm with a range resolution of 87.2(+/-5.9) cm. The 16-channel multistatic solution results in a 2-dimensional localization error of 7.7(+/-3.1) cm and a comparative analysis is performed against the netted monostatic solution. Results show that active sensing with a low probability of intercept (LPI) multistatic radar, like the NoNET, is capable of producing sub-meter accuracy and near meter-resolution imagery.

DTIC

Multistatic Radar; Radar Equipment; Random Noise

20100019469 NASA Glenn Research Center, Cleveland, OH, USA

Phased Array Noise Source Localization Measurements Made on a Williams International FJ44 Engine

Podboy, Gary G.; Horvath, Csaba; March 2010; 24 pp.; In English; 15th Aeroacoustics Conference, 11-13 May 2009, Miami, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.0318.02

Report No.(s): NASA/TM-2010-216228; AIAA Paper 2009-3183; E-17215; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100019469

A 48-microphone planar phased array system was used to acquire noise source localization data on a full-scale Williams International FJ44 turbofan engine. Data were acquired with the array at three different locations relative to the engine, two on the side and one in front of the engine. At the two side locations the planar microphone array was parallel to the engine centerline; at the front location the array was perpendicular to the engine centerline. At each of the three locations, data were acquired at eleven different engine operating conditions ranging from engine idle to maximum (take off) speed. Data obtained with the array off to the side of the engine were spatially filtered to separate the inlet and nozzle noise. Tones occurring in the inlet and nozzle spectra were traced to the low and high speed spools within the engine. The phased array data indicate that the Inflow Control Device (ICD) used during this test was not acoustically transparent; instead, some of the noise emanating from the inlet reflected off of the inlet lip of the ICD. This reflection is a source of error for far field noise

measurements made during the test. The data also indicate that a total temperature rake in the inlet of the engine is a source of fan noise.
Author
Aerodynamic Noise; Inlet Nozzles; Noise Generators; Phased Arrays; Turbofan Engines

20100019675 Naval Undersea Warfare Center, Newport, RI USA
Detecting Class-Independent Linear Relationships Within an Arbitrary Set of Features
Sarma, Ashwin; Jan 2007; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-04-WX-02326
Report No.(s): AD-A518947; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518947

Classifiers for surveillance sonar systems are often designed to operate on large sets of predefined clues, or features. Sometimes the mathematical definitions for these features are poorly known. Other times the designer is not aware that a fixed and class-independent linear (or affine) relationship exists between subsets of features. We discuss a method based on Gram-Schmidt orthogonalization which allows the classifier designer to determine whether subsets of features have such relationships. Certain features can then be shown unnecessary by application of Wozencraft and Jacobs' Theorem of Irrelevance. An approach is also described to rank features to aid in the selection of an effective subset.
DTIC
Detection; Sonar

20100019717 Naval Research Lab., Bay Saint Louis, MS USA
A Report of the NRL Technical Metrics Workshop 2008
Fabre, Josette P; Apr 9, 2010; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519035; NRL/FR/7180-10-10196; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519035

A Technical Metrics Workshop was developed by the NRL Acoustics Division and held at NRL Stennis Space Center, MS, from April 29 to May 1, 2008. The primary goal of the workshop was to identify state-of-the-art technical and scientific metrics needed by the acoustic and oceanographic research and development communities. Secondary goals were to relate scientific/technical metrics to engineering and operational performance metrics, and to outline the propagation of errors and uncertainties using metrics variability. Thirty-eight presentations were given, representing participation from four U.S. Navy commands, six universities, and four private sector corporations, with foreign participation from the UK. This report summarizes the presentations, discussions, and conclusions of the workshop. It will serve as a useful reference for building consistent technical metrics within the ocean and acoustic research and development communities, as well as providing common guidance for measuring exit and milestone criteria and for quantifying the contributions of interdisciplinary projects.
DTIC
Acoustics; Antisubmarine Warfare

20100019747 Norwegian Seismic Array, Kjeller, Norway
Basic Research on Seismic and Infrasonic Monitoring of the European Arctic
Ringdal, Frode; Kvaerna, Tormod; Mykkeltveit, Svein; Gibbons, Steven J; Schweitzer, Johannes; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-C-0224
Report No.(s): AD-A519121; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519121

The objective of the project is to carry out research to improve the current capabilities for monitoring small seismic events in the European Arctic, which includes the former Russian test site at Novaya Zemlya. The project has three main components: a) to improve seismic processing in this region using the regional seismic arrays installed in northern Europe, b) to investigate the potential of using combined seismic/infrasonic processing to characterize events in this region and c) to carry out experimental operation, evaluation and tuning of the seismic threshold monitoring technique, with applications to various regions of monitoring interest.
DTIC
Arctic Regions; Europe; Explosions; Infrasonic Frequencies; Research

20100019866 Southern Methodist Univ., Dallas, TX USA

Infrasound in the Zone of Silence

Herrin, Eugene T; Golden, Paul W; Negraru, Petru T; McKenna, Mihan H; Sep 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W9113M-06-C-0028

Report No.(s): AD-A519293; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Experiments designed to understand the propagation of infrasound signals at distances of less than 200 km were conducted in central Nevada, USA during the week of 11 September 2006. A controlled suite of explosions on the surface, designed to destroy surplus military ordnance, provided the source of the infrasound signals. Three temporary 4-element infrasound arrays were deployed in a line due north of the sources at distances from 76 to 157 km. In addition, seismo-acoustic data was provided by the permanent Nevada Infrasound Array (NVIAR) and collocated seismic array NVAR, located about 36 km east of the source. The experiment was successful, and detections from all explosions were recorded at all arrays. Therefore, the assumption of the absence of signals in the 'zone of silence' is incorrect in this case. At NVIAR the shorter distance and impulsive signals indicated the arrival of direct waves. However, other signals recorded at distances of 76 to 157 km were longer in duration, and initial travel time analysis indicated the rays were turning in the stratosphere. Simultaneous balloon launched rawinsonde weather recordings collected between the sources and the stations through the tropopause showed there were no conditions that would allow turning rays or reflections in the troposphere. Because the travel times were too short for turning rays above the stratosphere, we conclude that the energy was refracted in the stratosphere. Obviously improved atmospheric models through the stratosphere are needed to explain the occurrence of infrasound signals in the zone of silence.

DTIC

Acoustic Measurement; Arrays; Explosions; Infrasonic Frequencies

20100019908 Naval Undersea Warfare Center, Newport, RI USA

Passive Acoustic Detection and Localization of Mesoplodon Densirostris (Blainville's Beaked Whale) Vocalization Using Distributed Bottom-Mounted Hydrophones in Conjunction With a Digital Tag (DTAG) Recording

Ward, Jessica; Morrissey, Ronald; Moretti, David; DiMarzio, Nancy; Jarvis, Susan; Johnson, Mark; Tyack, Peter; White, Charles; Oct 2008; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519438; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Click data from a tagged Mesoplodon densirostris was compared with broadband acoustic recordings from an 82 hydrophone wide-baseline array located in the Tongue of the Ocean, Bahamas. Two detectors, an Fast Fourier Transform (FFT) based detector and matched filter, were evaluated in white noise and with the acoustic recordings from the array for performance detecting M. densirostris clicks. The matched filter performed the best, allowing 92% of the tagged animal's clicks to be detected on at least one hydrophone. Time-Difference-of-Arrivals (TDOAs) between the DTag and the surrounding hydrophones were computed. These TDOAs were used to compute a three-dimensional hyperbolic localization track of the tagged animal. A maximum detection range of 6500 m from the tagged animal to the recording hydrophone was observed. Offset aspect angles were determined from the DTag heading information and the bearing to the receiving hydrophone. Clicks within plus or minus 30 degrees were detected at the farthest ranges, while clicks were detected at all off-set angles at closer ranges.

DTIC

Data Recording; Digital Systems; Hydrophones; Position (Location); Sound Detecting and Ranging; Whales

20100020197 Sandia National Labs., Albuquerque, NM USA

Seismic and Infrasound Sensor Testing Using Three-Channel Coherence Analysis

Hart, Darren; Merchant, John; Chael, Eric P.; September 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC04-94AL85000

Report No.(s): AD-A519294; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sleeman, van Wettum, and Trampert (2006) recently introduced a method for measuring the intrinsic noise spectra of seismic sensors which relies on determining the mutual signal coherence among three similar, collocated instruments. Unlike standard two-channel coherence tests, the available comparisons among three sensors allow the total incoherent noise power to be uniquely distributed among the individual sensors. We are looking to add this technique to the suite of tests we use for evaluating sensors at Sandia National Laboratories' Facility for Acceptance, Calibration, and Testing (FACT) site. In this paper, we briefly describe the method and demonstrate its effectiveness using synthetic signals with known amounts of coherent and incoherent power. Next we apply the procedure to characterize broadband STS2 low-gain seismometers set up

in a vault at the Albuquerque Seismological Laboratory (ASL) of the USA Geological Survey (USGS). In addition, we have tested some Chaparral 2.5 infrasound sensors, first exposed to ambient atmospheric background and then isolated inside a sealed test chamber for recording a controllable broadband pressure source. We also looked at determining digitizer self-noise with this technique by feeding a single seismometer component (vertical) into three channels of a common digitizer electronics board. These test configurations allowed us to investigate two primary aspects of the input signal character, i.e., signal-to-noise ratio (SNR) and background vs. generated signals. They also allow us to investigate the linearity aspects of the sensor and digitizer in the presence of large background signals. Besides permitting the proper allocation of the incoherent noise among the three sensors, the technique also produces more stable sensor noise estimates in high signal-to-noise situations than the two-channel approach, as long as the participating sensors have reasonably similar performance over the analysis band.
DTIC
Acoustics; Infrasonic Frequencies; Seismographs; Signal Detectors

20100020269 Los Alamos National Lab., NM USA
Infrasound Monitoring of Local, Regional and Global Events
Arrowsmith, Stephen J.; ReVelle, Douglas O.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference; September 2007, pp. 815-824; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies Conference, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-AC52-06NA25396
Report No.(s): AD-A519497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Methodologies for the detection, association, location and identification of infrasound sources at local, regional and global distances are discussed. In the first part of this paper we apply a new regional monitoring method to data from the Washington State seismo-acoustic network and identify 206 local and regional infrasonic events in a dataset comprising 28 days of data. We detect multiple signals from mining explosions at two sites in Washington State, including 5 events that were recorded in a regional seismic bulletin. We also automatically detect and associate signals from the March 9th 2005 eruption at Mount Saint Helens, and locate the event to be within 5 km of the caldera. The second part of this paper outlines a technique for identifying infrasound signals from large known events on a global scale. We apply the technique to data from International Monitoring System (IMS) infrasound arrays for three super-bolides occurring on September 3rd, 2004, over Antarctica; on October 7th, 2004, over the Indian Ocean; and on December 9th, 2006, over North Africa. For each bolide we observe signals at multiple infrasonic arrays, with observations at ranges from tilde 1,000 to tilde 13,000 km. We investigate the causes of the asymmetric distributions of observations and show that site-noise is a dominant effect up to a range of tilde 10,000 km. We discuss how the preliminary work outlined in this paper provides important constraints for the purpose of event identification at local, regional and global distances. For large events, we outline how the synthesis of local, regional and global infrasonic data would provide the optimum dataset for event location and identification.
DTIC
Infrasonic Frequencies; Data Systems; Position (Location)

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20100019776 Naval Surface Warfare Center, Indian Head, MD USA
Hydroacoustic Propagation Through the Antarctic Convergence Zone: Study of Errors in Yield and Location Estimates for Explosive Charges
de Groot-Hedlin, C; Blackman, Donna K; Jenkins, C S; Sep 2007; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9113M-05-1-0019
Report No.(s): AD-A519212; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519212

A series of small calibration shots was conducted in late December 2006, along a transect from New Zealand to Antarctica in order to document the differences in spectral characteristics, transmission loss, travel-time, and azimuth both observed and predicted using propagation models typical for nuclear monitoring. The high gradients in ocean temperature and salinity that characterize the Antarctic Convergence Zone (ACZ) are expected to alter the propagation path, and the commonly rough sea

surface is likely to scatter significant energy from sources south of - 53 degrees S, where the sound channel breaches the surface. Seasonal variability in the ACZ makes it difficult to model such effects accurately at all times, so our experiment was designed to determine the scale of error introduced by such uncertainty in structure. Depth charges, set to trigger at 300, 460, and 600 m, were deployed at 6 stations between 54 degrees S and 63 degrees S. The International Monitoring System (IMS) hydroacoustic station off Cape Leeuwin, Australia, recorded shots from all but one site. Macquarie Ridge probably blocked that source area. Several shots were also recorded at the Diego Garcia and Juan Fernandez IMS stations. This new data set will be characterized in terms of source-receiver transmission loss and spectral characteristics, used to infer source yield, as well as source location errors. Preliminary analysis of arrivals at IMS hydroacoustic stations in the Indian Ocean indicates that the time duration of each arrival depends on source location, and not on source depth or size. Conversely, the spectral content of the signals depends on source depth and charge size, but not on the source location.
DTIC
Antarctic Regions; Calibrating; Convergence; Depth; Errors; Estimates; Position (Location); Spectral Energy Distribution; Transmission Loss; Underwater Acoustics

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20100018950 Naval Postgraduate School, Monterey, CA USA
What Are the Security Threats to Further Development of Nuclear Power Plants in the U.S
Nottestad, Tammie L; Mar 2010; 128 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518537; No Copyright; Avail.: Defense Technical Information Center (DTIC)

What are the security threats to further development of nuclear power plants in the U.S.? The U.S. stands alone today in terms of the vast nuclear armory at its disposal. It is clear we know something about how to build nuclear weapons, and yet, we are not world leaders in the field of nuclear power. Nuclear energy has the potential to be an alternative fuel source that would be sustainable and economical. Nuclear power is controversial in the U.S. because it raises issues of domestic energy policy, funding, regulation, safety, and especially security. In turn it can affect U.S. investments, foreign policy, economy, and jobs. As America struggles with its dependence on foreign oil, we must seek alternative fuel sources. The President has made energy a priority and is pushing for a clean energy economy. Not to pursue alternative fuel sources will directly impact our ability to be economically competitive, as other countries will have cheaper electricity for manufacturing and services. We need to protect the U.S. from economic and strategic risks associated with our reliance on foreign oil. We also need to address the destabilizing effects of a changing climate, Internet is heavily impacted by our energy use.
DTIC
Nuclear Power Plants; Security; Terrorism

20100018995 Naval Postgraduate School, Monterey, CA USA
The Proposed Fissile Material Cutoff Treaty (FMCT) and Its Potential Impact on U.S. Navy Nuclear Propulsion Programs
Burgess, Jr, Marion; Mar 2010; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518645; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis examines the problems that USA Navy nuclear propulsion programs might encounter if the USA agreed to sign a version of the proposed Fissile Material Cut-off Treaty (FMCT) affecting the production of nuclear reactor fuel. The ultimate purpose of the FMCT is to contribute to the fulfillment of the goal of nuclear disarmament by terminating the production of plutonium and highly enriched uranium for weapon purposes. This thesis explores the potential impact of an FMCT on the U.S. Navy's nuclear propulsion systems. It also examines other options that might be available to the USA Navy to proceed with its nuclear propulsion programs (such as using low-enriched uranium as reactor fuel), as well as to maintain the security of its propulsion reactor designs.
DTIC
Fissionable Materials; Navy; Nuclear Propulsion; Nuclear Reactors

20100019679 Library of Congress, Washington, DC USA
U.S. Nuclear Cooperation with India: Issues for Congress
Kerr, Paul K; Apr 8, 2010; 48 pp.; In English
Report No.(s): AD-A518957; CRS-RL33016; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518957

India, which has not signed the Nuclear Nonproliferation Treaty (NPT) and does not have International Atomic Energy Agency safeguards on all nuclear material in peaceful nuclear activities, exploded a peaceful nuclear device in 1974, convincing the world of the need for greater restrictions on nuclear trade. The USA created the Nuclear Suppliers Group (NSG) as a direct response to India's test, halted nuclear exports to India a few years later, and worked to convince other states to do the same. India tested nuclear weapons again in 1998. However, President Bush announced July 18, 2005, he would work to achieve full civil nuclear energy cooperation with India and would also seek agreement from Congress to adjust U.S. laws and policies, in the context of a broader partnership with India. On September 27, 2008, the House passed H.R. 7081, which approved the agreement. The Senate Committee on Foreign Relations approved identical legislation, S. 3548, September 23. The Senate passed H.R. 7081 October 1. President Bush signed P.L. 110-369 into law October 8. Secretary of State Condoleezza Rice and India's External Affairs Minister Shri Pranab Mukherjee signed the agreement October 10, and it entered into force December 6, 2008.
DTIC
Agreements; India; United States

20100019728 Duke Univ., Durham, NC USA
Strongly-Interacting Fermi Gases in Reduced Dimensions
Thomas, John E; May 29, 2009; 12 pp.; In English
Contract(s)/Grant(s): W911NF-05-1-0273
Report No.(s): AD-A519063; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519063

Optically-trapped, strongly-interacting Fermi gases are models for exotic strongly-interacting systems in nature. For this reason, tabletop experiments with strongly-interacting atomic Fermi gases can provide measurements that are relevant to all strongly-interacting Fermi systems, thus impacting theories in intellectual disciplines outside atomic physics, including materials science and condensed matter physics (superconductivity), nuclear physics (nuclear matter), high-energy physics (effective theories of the strong interactions), astrophysics (compact stellar objects), the physics of quark-gluon plasmas (elliptic flow), and most recently, string-theory (minimum viscosity hydrodynamics). Recent experiments have been carried out in a three dimensional geometry, where the adiabatic local density approximation is valid. The purpose of this program is to explore strongly-interacting Fermi gases in a two-dimensional pancake geometry, where the simplest approximations break down.
DTIC
Carbon Dioxide Lasers; Fermions

20100019944 Texas Univ., Austin, TX USA
Pseudospintronics: Final Report
MacDonald, A H; Jan 17, 2010; 7 pp.; In English
Contract(s)/Grant(s): W911NF-06-1-0360
Report No.(s): AD-A519508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The central aim of this project was to explore the influence of electron-electron interactions on electronic transport in a variety of circumstances. A key goal was to invent new physics based on analogies to spintronics. Spintronics is a well established field which explores the role of the spin degree-of-freedom in transport. The PI invented the phrase pseudospintronics, which is now coming into common use, to refer to spintronics like phenomena in which the role of spin is taken over by some other two-valued quantum degree of freedom. In one key class of pseudospintronic phenomena, the role of spin is replaced by the layer degree-of-freedom in a two-layer system. Although progress was achieved by work supported by this grant, ideas are still evolving. This ARO supported grant has helped to nucleate the field of pseudospintronics.
DTIC
Electron Scattering; Electron Transfer; Semiconductors (Materials)

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20100018744 Centre National d'Etudes Spatiales, Toulouse, France
Time Transfer by Laser Link - T2L2: Results of the First Year of Operation
Guillemot, Philippe; Exertier, Pierre; Samain, Etienne; Pierron, Francis; Torre, Jean-Marie; Leon, Sylvie; Nov 2009; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518021; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518021

The Time Transfer by Laser Link (T2L2) experiment is a joint CNES and OCA space mission that will perform ground-to-ground time transfer with an expected time stability of about 1 ps over 1,000 s and 10 ps over 1 day and a time accuracy in the 100 ps range. The T2L2 instrument is onboard the Jason-2 satellite launched in June 2008. It has been in operation for 18 months. After a short period devoted to the characterization and the calibration of the system, the mission is in its operational phase. First ground-to-space time transfers have demonstrated noise levels of some tens of picoseconds and a preliminary time stability of a few picoseconds over integration times of some tens of seconds, clearly limited by the onboard clock. The 2009 T2L2 experimental program has two major experiences. The first one is a common-clock time transfer between two co-located laser stations MeO and FTLRS. The second is the validation of a distant comparison between cold atoms fountain clocks and RF time transfer systems. This validation is done with 3 regular laser stations (France, Poland, Japan) and also the French transportable laser ranging system (FTLRS) based at Paris (Syrte). The availability on these sites of both a GPS and a TWSTFT station will allow a direct comparison of T2L2 with RF time transfer techniques.
DTIC
Gas Lasers; Lasers

20100018956 California Univ., Berkeley, CA USA
Ultrabroad Bandwidth Slow Light in Semiconductor Nanostructures
Chang-Hasnain, Constance; Dec 31, 2008; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-06-1-0920
Report No.(s): AD-A518547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Slow and fast light enables key functionality in various RF applications and all-optical networks. Semiconductor based schemes offer electrical control of velocity at very high bandwidths in an extremely compact device. Further they operate at room temperature and can be easily integrated into various optical systems. Ultra-fast non-linear processes in semiconductor optical amplifiers (SOAs) have been used to achieve tunable advance and delay at THz bandwidth. For a 700 fs pulse, we show electrically and optically controllable advance of 1.9 ps corresponding to an advance-bandwidth product (ABP) of 2.5. Further, by leveraging self-phase modulation in these devices we extend the performance to an ABP of 3.7. We develop comprehensive theory using density matrix approach to explain the experimental results. Our results show that an ultra-short pulse propagating through the SOA experiences non-linear index change due to spectral-hole burning and wave mixing between different spectral components. We derive analytical expressions for nonlinear index induced by these ultra-fast processes and numerically solve the propagation of an ultra-short pulse through the SOA. Our theoretical predictions agree very well with our experimental results. Finally, we show fast light for two ultra-short pulses separated by 7.2ps which demonstrates the feasibility of this scheme at high bit-rates.
DTIC
Bandwidth; Light (Visible Radiation); Light Amplifiers; Nanostructures (Devices); Semiconductor Devices; Semiconductors (Materials)

20100019257 NASA Goddard Space Flight Center, Greenbelt, MD, USA
BRDF Calibration of Sintered PTFE in the SWIR
Georgiev, Georgi T.; Butler, James J.; August 2, 2009; 9 pp.; In English; SPIE Optics and Photonics 2009, 2-6 Aug. 2009, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019257

Satellite instruments operating in the reflective solar wavelength region often require accurate and precise determination of the Bidirectional Reflectance Distribution Function (BRDF) of laboratory-based diffusers used in their pre-flight calibrations and ground-based support of on-orbit remote sensing instruments. The Diffuser Calibration Facility at NASA's

Goddard Space Flight Center is a secondary diffuser calibration standard after NEST for over two decades, providing numerous NASA projects with BRDF data in the UV, Visible and the NIR spectral regions. Currently the Diffuser Calibration Facility extended the covered spectral range from 900 nm up to 1.7 microns. The measurements were made using the existing scatterometer by replacing the Si photodiode based receiver with an InGaAs-based one. The BRDF data was recorded at normal incidence and scatter zenith angles from 10 to 60 deg. Tunable coherent light source was setup. Broadband light source application is under development. Gray-scale sintered PTFE samples were used at these first trials, illuminated with P and S polarized incident light. The results are discussed and compared to empirically generated BRDF data from simple model based on 8 deg directional/hemispherical measurements.
Author
Bidirectional Reflectance; Polarized Light; Satellite Instruments; Remote Sensing; Coherent Light; Calibrating; Sintering; Photodiodes

20100019258 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Effect of Charging Electron Exposure on 1064nm Transmission Through Bare Sapphire Optics and SiO2 over HfO2 AR-Coated Sapphire Optics
Ottens, Brian P.; Connelly, Joseph; Brown, Stephen; Roeder, James; Kauder, Lonny; Cavanaugh, John; [2010]; 5 pp.; In English; 26th Space Simulation Conference, 18-21 Oct. 2010, Annapolis, MD, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019258
Experiments measuring the effect of electron exposure on 1064nm transmission for optical sapphire were conducted. Detailed before and after inspections did not identify any resulting Litchenburg patterns. Pre- and post-exposure 1064nm transmission measurements are compared.
Author
Sapphire; Radiation Belts; Coatings; Silicon Dioxide; Laser Altimeters; Exposure

20100019530 Minnesota Univ., Minneapolis, MN, USA
Theory of Optical and Electronic Properties of Clusters and Nanostructures. (07/01/1989 to 06/30/2006)
Chelikowsky, J. R.; Moncrief, W. A.; January 2006; 17 pp.; In English
Contract(s)/Grant(s): DE-FG02-89ER45391
Report No.(s): DE2010-948116; No Copyright; Avail.: Department of Energy Information Bridge
The work reported here took place at the University of Minnesota from 07/01/1989 to 06/30/2006. Most of this work focused on computational materials applied to oxides during the first part of this funding period and to nanoscale materials toward the end of the funding period. This funding resulted in three monographs, 36 invited articles or book chapters, 160 articles in refereed journals and 89 invited talks. The funding helped train 13 PhD students and one masters student. The PI received two national research awards for this work. A list of these contributions are presented.
NTIS
Electrical Properties; Molecular Clusters; Nanostructures (Devices); Optical Properties

20100019552 Ohio State Univ., Columbus, OH, USA
Development of Single Crystal Chemical Vapor Deposition Diamonds for Detector Applications
Kagan, H.; Gan, K. K.; Kass, R.; Mar. 31, 2009; 9 pp.; In English
Contract(s)/Grant(s): FG02-06ER41432
Report No.(s): DE2010-950473; DOE/ER-41432-1; No Copyright; Avail.: National Technical Information Service (NTIS)
Diamond was studied as a possible radiation hard technology for use in future high radiation environments. With the commissioning of the LHC expected in 2009, and the LHC upgrades expected in 2013, all LHC experiments are planning for detector upgrades which require radiation hard technologies. Chemical Vapor Deposition (CVD) diamond has now been used extensively in beam conditions monitors as the innermost detectors in the highest radiation areas of BaBar, Belle and CDF and is installed in all LHC experiments. As a result, this material is now being discussed as an alternative sensor material for tracking very close to the interaction region of the super-LHC where the most extreme radiation conditions will exist. Our work addressed the further development of the new material, single-crystal Chemical Vapor Deposition diamond, towards reliable industrial production of large pieces and new geometries needed for detector applications.
NTIS
Diamonds; Single Crystals; Vapor Deposition

20100019554 Minnesota Univ., Minneapolis, MN, USA

Scalable Methods for Electronic Excitations and Optical Responses in Nanostructures: Mathematics to Algorithms to Observables

Chelikowsky, J. R.; Mar. 31, 2009; 5 pp.; In English

Contract(s)/Grant(s): FG02-03ER15491

Report No.(s): DE2010-950463; DOE/ER-15491-1; No Copyright; Avail.: Department of Energy Information Bridge

The research supported by this grant focused on developing theoretical methods for predicting and understanding the properties of matter at the nanoscale. Within this regime, new phenomena occur that are characteristic of neither the atomic limit, nor the crystalline limit. Moreover, this regime is crucial for understanding the emergence of macroscopic properties such as ferromagnetism. For example, elemental Fe clusters possess magnetic moments that reside between the atomic and crystalline limits, but the transition from the atomic to the crystalline limit is not a simple interpolation between the two size regimes. To capitalize properly on predicting such phenomena in this transition regime, a deeper understanding of the electronic, magnetic and structural properties of matter is required, e.g., electron correlation effects are enhanced within this size regime and the surface of a confined system must be explicitly included. A key element of our research involved the construction of new algorithms to address problems peculiar to the nanoscale. Typically, one would like to consider systems with thousands of atoms or more, e.g., a silicon nanocrystal that is 7 nm in diameter would contain over 10,000 atoms. Previous ab initio methods could address systems with hundreds of atoms whereas empirical methods can routinely handle hundreds of thousands of atoms (or more). However, these empirical methods often rely on ad hoc assumptions and lack incorporation of structural and electronic degrees of freedom. The key theoretical ingredients in our work involved the use of ab initio pseudopotentials and density functional approaches.

NTIS

Algorithms; Excitation; Nanostructures (Devices)

20100019645 Rhode Island Univ., Narragansett, RI USA

Wave Induced Bubble Clouds and their Effect on Radiance in the Upper Ocean

Farmer, David M; Vagle, Svein; Jan 2008; 6 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0072

Report No.(s): AD-A518849; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518849

A goal of this project is to measure wave induced bubble clouds and their effect on radiance in the upper ocean and to address the fact that despite the fundamental importance of optical backscatter in the ocean it is still not possible to explain more than 5 to 10 percent of the particulate backscattering in the ocean based on known constituents even during periods with no active wave breaking. We want to investigate the role of upper ocean bubbles in these processes. In this project we are working closely with Svein Vagle (IOS).

DTIC

Bubbles; Light Scattering; Ocean Surface; Oceans; Radiance; Water Waves

20100019648 Rutgers - The State Univ., New Brunswick, NJ USA

Using Gliders to Resolve Dynamics of Dust and Phytoplankton in the Mediterranean

Schofield, Oscar M; Glenn, Scott; Trees, Chuck; Jan 2008; 6 pp.; In English

Contract(s)/Grant(s): N00014-08-4-0004

Report No.(s): AD-A518856; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518856

Optical properties are complex representing variable contributions of phytoplankton, Colored Dissolved Organic Matter (CDOM), marine and atmospherically derived non-algal particles. The relative contributions of these are particularly complex for enclosed inland seas such as the Mediterranean. Results have shown that it is especially critical to collect regional ocean color data from satellites, which must be complemented with spatial subsurface measurements, which can be measured with the physical/optical sensor packages mounted on Webb gliders. We propose to use Webb Gliders to provide a regional subsurface physical and optical dataset to support ship-based NASA, NATO, and ONR efforts being conducted in the Mediterranean in late spring 2008 and early Autumn 2009. The Gliders will be used to map the subsurface features over monthly timescales and assess to what degree the non-algal particles are spatially and temporally correlated in space and time.

DTIC

Dust; Gliders; Mediterranean Sea; Optical Properties; Phytoplankton; Underwater Vehicles

20100019659 Naval Surface Warfare Center, Panama City, FL USA
Optics Near the Snell Angle in a Water-to-Air Change of Medium
Suiter, H; Flacco, N; Carter, Paul; Tong, Kelvin; Ries, Ryan; Gershenson, Meir; Jan 2007; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518875; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518875

Underwater imaging of the air environment is described with particular attention given to the optical problems of near-horizon viewing. These include severe chromatic aberration from transmission through the seawater wedge, the horizon distortion effect, and anisoplanatism resulting from the change of refractive aberrations in different areas of view. Various optical designs or schemes are presented that correct or relieve the first two optical problems. Strategies to minimize or attempt to view through the varying refraction of the surface are also suggested, and one is investigated.
DTIC
Optical Properties; Water

20100019725 Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, ME USA
Nanoparticles and Ocean Optics
Balch, William M; Vaughn, James; Goes, Joaquim I; Jan 2008; 10 pp.; In English
Contract(s)/Grant(s): N00014-05-1-0111
Report No.(s): AD-A519059; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519059

Our long-term goal is to understand the role of the two most abundant nanoparticles in the sea, viruses and polymer aggregates and their impact on the inherent ocean optical properties of seawater. There are two objectives to this work that deal with the role of nanoparticles and ocean optics: 1. To determine the importance of viruses (and other biological processes) in the formation of chromophoric dissolved organic matter (CDOM) in the ocean through lysis of host cells. 2. To quantify the importance of aggregate formation to seawater optical properties.
DTIC
Dissolved Organic Matter; Nanoparticles; Oceans; Optical Properties; Sea Water; Viruses

20100019726 Miami Univ., Coral Gables, FL USA
Effective Modulation Transfer Function of Light Transmission through Rough Ocean Surfaces
Voss, Kenneth J; Jan 2008; 3 pp.; In English
Contract(s)/Grant(s): N00014-06-1-0388
Report No.(s): AD-A519061; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519061

My work involves experimentally investigating the interrelationships and variability of optical properties in the ocean and atmosphere. My goal is to define the variability of the optical properties, particularly those dealing with light scattering, and to improve the prediction capabilities of image and radiative transfer models used in the ocean. My near term ocean optics objectives have been: 1) to improve the measurement capability of measuring the in-water and above-water spectral radiance distribution and extending this capability to polarization, 2) to investigate the variability of the Point Spread Function (PSF) as it relates to the imaging properties of the ocean, and 3) to improve the characterization of the Bi-directional Reflectance Distribution Function (BRDF) of benthic surfaces in the ocean, and 4) to understand the capabilities and limitations of using radiative transfer to model the BRDF of particulate surfaces. The original PI on this grant, Tony Elfouhaily, passed away. I have now taken over this grant, but the objectives have changed as the work is now combined with my work looking at the downwelling spectral polarized radiance distribution, in the near surface of the ocean. The objective of this work is to investigate the polarization of the downwelling light field near the surface.
DTIC
Light Transmission; Modulation Transfer Function; Ocean Surface; Optical Properties; Radiance

20100019741 Naval Research Lab., Bay Saint Louis, MS USA
Evaluating Realistic Volume Scattering Functions on Underwater Imaging System Performance
Gray, Deric J; Weidemann, Alan; Jan 2008; 7 pp.; In English
Contract(s)/Grant(s): MIPR-N0001408WX21321
Report No.(s): AD-A519106; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519106

The Navy has a continuing and pressing need to improve its ability to visually detect and identify underwater objects. As

far as imaging environments go, this is one of the worst: absorption and scattering by the water and the dissolved and particulate within rob a system of its signal and blur the resulting image. Sophisticated systems like the Laser Line Scanner (LLS) and the Streak-Tube Imaging LIDAR (STIL) have been designed and engineered to address some of these difficulties. But while engineering properties of an imaging system can be decided upon and controlled to a certain extent, it is most often the variable environmental conditions that are the limiting factors to system performance and, ultimately, utility. Our goal is to evaluate the effects of these environmental conditions on the performance of underwater imaging systems.
DTIC
Imaging Techniques; Optical Properties; Scattering; Scattering Functions

20100019910 Sea Engineering, Inc., Santa Cruz, CA USA
Radiance in a Dynamic Ocean (RaDyO): Radiance and Visibility as Affected by Inherent Optical Properties
Chang, Grace; Jan 2009; 10 pp.; In English
Contract(s)/Grant(s): N00014-09-C-0443
Report No.(s): AD-A519440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of Radiance in a Dynamic Ocean (RaDyO): Radiance and Visibility as Affected by Inherent Optical Properties is to perform detailed investigations of inherent optical properties (IOPs) and the effects of IOP variability on underwater radiance and visibility. As part of this effort, Sea Engineering, Inc. (SEI) will also provide all data from the Scripps Pier and Santa Barbara Channel (SBC) RaDyO experiments to the ONR and to all other RaDyO investigators, with a detailed report describing the technical approach and algorithms used for data processing. The primary objectives of the Radiance in a Dynamic Ocean (RaDyO) program are to: 1) Examine time-dependent oceanic radiance distribution in relation to dynamic surface boundary layer (SBL) processes. 2) Construct a radiance-based SBL model. 3) Validate the model with field observations. 4) Investigate the feasibility of inverting the model to yield SBL conditions. As part of the RaDyO project, SEI will perform RaDyO IOP data processing and analysis including data sharing with other RaDyO PIs. Data post-processing includes application of field-calibrations, corrections for temperature, salinity, and scattering effects, and comparisons with similar IOP data collected by RaDyO collaborators. IOP data analysis as related to the RaDyO program will include detailed investigations of the differences, if any, between optical properties and optical variability measured off the R/P FLIP and off the R/V Kilo Moana (KM) during the RaDyO SBC experiment and the effects of optical variability on the modeling of the underwater radiance distribution and visibility.
DTIC
Oceans; Optical Properties; Radiance; Visibility

20100019911 Naval Academy, Annapolis, MD USA
Crepuscular and Nocturnal Illumination and Its Effects on Color Perception by the Nocturnal Hawkmoth Deilephila elpenor
Johnsen, Sonke; Kelber, Almut; Warrant, Eric; Sweeney, Alison M; Widder, Edith A; Lee, Jr, Raymond L; Hernandez-Andres, Javier; Jan 2006; 14 pp.; In English
Report No.(s): AD-A519442; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Recent studies have shown that certain nocturnal insect and vertebrate species have true color vision under nocturnal illumination. Thus, their vision is potentially affected by changes in the spectral quality of twilight and nocturnal illumination, due to the presence or absence of the moon, artificial light pollution and other factors. We investigated this in the following manner. First we measured the spectral irradiance (from 300 to 700 nm) during the day, sunset, twilight, full moon, new moon, and in the presence of high levels of light pollution. The spectra were then converted to both human-based chromaticities and to relative quantum catches for the nocturnal hawkmoth Deilephila elpenor, which has color vision. The reflectance spectra of various flowers and leaves and the red hindwings of D. elpenor were also converted to chromaticities and relative quantum catches. Finally, the achromatic and chromatic contrasts (with and without von Kries color constancy) of the flowers and hindwings against a leaf background were determined under the various lighting environments. The twilight and nocturnal illuminants were substantially different from each other, resulting in significantly different contrasts. The addition of von Kries color constancy significantly reduced the effect of changing illuminants on chromatic contrast, suggesting that, even in this light-limited environment, the ability of color vision to provide reliable signals under changing illuminants may offset the concurrent threefold decrease in sensitivity and spatial resolution. Given this, color vision may be more common in crepuscular and nocturnal species than previously considered.
DTIC
Color Vision; Insects; Night Vision; Nocturnal Variations

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20100018379 Columbia Univ., New York, NY, USA; Princeton Plasma Physics Lab., Princeton, NJ, USA; Cray, Inc., Seattle, WA, USA

Performance of Particle in Cell Methods on Highly Concurrent Computational Architectures

Adams, M. F.; Ethier, S.; Wichmann, N.; January 2007; 10 pp.; In English

Report No.(s): DE2010-963137; No Copyright; Avail.: National Technical Information Service (NTIS)

Particle in cell (PIC) methods are effective in computing Vlasov-Poisson system of equations used in simulations of magnetic fusion plasmas. PIC methods use grid based computations, for solving Poissons equation or more generally Maxwells equations, as well as Monte-Carlo type methods to sample the Vlasov equation. The presence of two types of discretizations, deterministic field solves and Monte-Carlo methods for the Vlasov equation, pose challenges in understanding and optimizing performance on today large scale computers which require high levels of concurrency. These challenges arises from the need to optimize two very different types of processes and the interactions between them. Modern cache based high-end computers have very deep memory hierarchies and high degrees of concurrency which must be utilized effectively to achieve good performance. The effective use of these machines requires maximizing concurrency by eliminating serial or redundant work and minimizing global communication. A related issue is minimizing the memory traffic between levels of the memory hierarchy because performance is often limited by the bandwidths and latencies of the memory system. This paper discusses some of the performance issues, particularly in regard to parallelism, of PIC methods. The gyrokinetic toroidal code (GTC) is used for these studies and a new radial grid decomposition is presented and evaluated. Scaling of the code is demonstrated on ITER sized plasmas with up to 16K Cray XT3/4 cores.

NTIS

Architecture (Computers); Nuclear Fusion; Plasmas (Physics)

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20100018490 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Linearly Scaling 3D Fragment Method for Large Scale Electronic Structure Calculations

Zhao, Zhengji; Meza, Juan; Lee, Byounghak; Shan, Hongzhang; Strohmaier, Erich; June 26, 2009; 5 pp.; In English

Contract(s)/Grant(s): DE-AC02-05CH11231

Report No.(s): DE2009-964376; LBNL-2162E; No Copyright; Avail.: National Technical Information Service (NTIS)

The Linearly Scaling three-dimensional fragment (LS3DF) method is an O(N) ab initio electronic structure method for large-scale nano material simulations. It is a divide-and-conquer approach with a novel patching scheme that effectively cancels out the artificial boundary effects, which exist in all divide-and-conquer schemes. This method has made ab initio simulations of thousand-atom nanosystems feasible in a couple of hours, while retaining essentially the same accuracy as the direct calculation methods. The LS3DF method won the 2008 ACM Gordon Bell Prize for algorithm innovation. Our code has reached 442 Tflop/s running on 147,456 processors on the Cray XT5 (Jaguar) at OLCF, and has been run on 163,840 processors on the Blue Gene/P (Intrepid) at ALCF, and has been applied to a system containing 36,000 atoms. In this paper, we will present the recent parallel performance results of this code, and will apply the method to asymmetric CdSe/CdS core/shell nanorods, which have potential applications in electronic devices and solar cells.

NTIS

Algorithms; Electronic Structure; Fragments

20100018523 Sandia National Labs., Albuquerque, NM, USA

Nanoporous Films for Epitaxial Growth of Single Crystal Semiconductor Materials: Final LDRD Report

Burckel, D. Bruce; Fan, Hongyou; Koleske, Dan D.; Rowen, Adam M.; Arrington, Christian L.; October 2007; 20 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL85000; ECS 03-35765

Report No.(s): DE2009-966925; SAND2007-6409; No Copyright; Avail.: Department of Energy Information Bridge

This senior council Tier 1 LDRD was focused on exploring the use of porous growth masks as a method for defect

reduction during heteroepitaxial crystal growth. Initially our goal was to investigate porous silica as a growth mask, however, we expanded the scope of the research to include several other porous growth masks on various size scales, including mesoporous carbon, photolithographically patterned SU-8 and carbonized SU-8 structures. Use of photolithographically defined growth templates represents a new direction, unique in the extensive literature of patterned epitaxial growth, and presents the possibility of providing a single step growth mask. Additional research included investigation of pore viability via electrochemical deposition into high aspect ratio photoresist. This project was a small footprint research effort which, nonetheless, produced significant progress towards both the stated goal as well as unanticipated research directions.
NTIS
Carbon; Crystal Growth; Epitaxy; Semiconductors (Materials); Silicon Dioxide; Single Crystals

20100018604 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA
A 2D Rods-in-Air Square-Lattice Photonic Crystal Optical Switch
Wang, H Z; Zhou, W M; Zheng, J F; Mar 2009; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-01-2-0014
Report No.(s): AD-A517588; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517588

A 2D photonic crystal optical switch is proposed based on a rods-in-air square-lattice photonic crystal by removing two cross-lines of rods from a 2D square-lattice photonic crystal to form four optical channels. The simulation results show that, when inserting a single rod along the diagonal line of the intersection area of two removed cross-lines of rods, the position of the single inserted rod determines how much incident energy goes into different channels. In the case of transverse magnetic (TM) Gaussian point source, time domain simulation shows that up to 87.3% of the incident energy can be switched into a channel, which is vertical to the source channel. Because there are two diagonal lines in the intersection area of two removed cross-lines of rods, the optical switch feature is achieved by shifting the inserted rod between two diagonal lines. It is also found that the magnitude of the reflected wave in the source channel varies greatly with spatial position of the single inserted rod. The larger the magnitude of the reflected wave in the source channel, the less the energy that goes into the switched channel. The time delay between the incident wave and the reflected wave in the source channel is also related to the position of the single inserted rod. In addition, the large time delay between the incident wave and the reflected wave in the source channel shows that the reflected wave encounters many reflections with the walls of the source channel, instead of waves reflected back from the single inserted rod.
DTIC
Crystals; Rods; Switches

20100018733 Naval Research Lab., Washington, DC USA
Creating Spin Currents in Silicon
Jonker, B T; Kioseoglou, G; Hanbicki, A T; Li, C H; Thompson, P E; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517999; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517999

The electronics industry to date has relied upon the control of charge flow, combined with size scaling (i.e., reducing the physical size of elements such as transistors), to continuously increase the performance of existing electronics. This trend, widely known as Moore's Law, has been remarkably successful. However, size scaling cannot continue indefinitely as atomic length scales are reached (the Moore's Law Roadblock), so new approaches must be developed. Basic research efforts at NRL and elsewhere have shown that spin angular momentum, another fundamental property of the electron, can be used to store and process information in solid-state devices. Subsequently, the International Technology Roadmap for Semiconductors has identified the electron's spin as a new state variable that should be explored for processing information in the fundamentally new ways that will be required beyond the ultimate scaling limits of silicon-based complementary metal-oxide-semiconductor (CMOS) technology. This approach is known as semiconductor spintronics. Electrical injection and transport of spin-polarized carriers is prerequisite for developing such an approach. To create spin-polarized carriers in silicon, we electrically inject them from a ferromagnetic metal contact, which naturally has more electrons with spin oriented in a particular direction determined by the magnetization (spin-up or majority spin) than in the opposite direction (spin-down or minority spin). The spin polarization in a typical ferromagnetic metal is approx. 45%. A thin layer of aluminum oxide between an iron contact and the silicon serves as a tunnel barrier to facilitate spin injection by controlling the series resistance and preventing interaction between the iron and the silicon.
DTIC
Angular Momentum; CMOS; Electron Transfer; Particle Spin; Quantum Numbers; Semiconductors (Materials); Silicon

20100018905 Maryland Univ., Baltimore, MD USA

Influence of Temperature on the Dynamic Structures of Psychrophilic Small Heat Shock Proteins

Robb, Frank T; Laksanalamai, Pongpan; Feb 27, 2010; 9 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0022

Report No.(s): AD-A518387; AF02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inappropriate aggregation of peptides and proteins is a major concern for biotechnology and is also associated with several major human pathological conditions. The goal of this project is to develop a robust method for refolding proteins and peptides by adapting novel protein salvage pathways from extremophiles to operate under mild conditions. In prior studies, we have shown that the chaperones from extremophiles are exceptionally stable and versatile, reflecting their role in folding and salvaging proteins under extreme conditions. The remarkably thermostable small Heat Shock Protein from the psychrotolerant archaeon Methanococcoides burtonii is our first choice for a holdase chaperone. This crystallin-like chaperone is stable from 15-55-deg C, and maintains aggregation-prone target proteins in the soluble state, without denaturants. In addition to applications of this pathway to recombinant proteins in solution and during expression in vivo, we propose to immobilize the chaperones to form a chaperone matrix.

DTIC

Biotechnology; Crystal Structure; Organisms; Proteins; Temperature Effects; Thermal Shock

20100019381 Fermi National Accelerator Lab., Batavia, IL, USA

Modeling Heavy Ion Ionization Energy Loss at Low and Intermediate Energies

Rakhno, I. L.; November 01, 2009; 11 pp.; In English

Contract(s)/Grant(s): DE-AC02-76CH03000

Report No.(s): DE2010-970064; FERMILAB-FN-0835-APC; No Copyright; Avail.: National Technical Information Service (NTIS)

The needs of contemporary accelerator and space projects led to significant efforts made to include description of heavy ion interactions with matter in general-purpose Monte Carlo codes. This paper deals with an updated model of heavy ion ionization energy loss developed previously for the MARS code. The model agrees well with experimental data for various projectiles and targets including super-heavy ions in low-Z media.

NTIS

Energy Dissipation; Ionization; Particle Accelerators

20100019399 National Inst. of Standards and Technology, Boulder, CO, USA

Variable-Temperature Critical-Current Measurements

Goodrich, L. F.; Stauffer, T. C.; May 19, 2009; 11 pp.; In English

Contract(s)/Grant(s): AI02-05ER54833

Report No.(s): DE2010-952565; DOE/ER-54833; No Copyright; Avail.: National Technical Information Service (NTIS)

This is the final report of a three year contract that covered 09/19/2005 to 07/14/2008. We requested and received a no cost time extension for the third year, 07/15/2007 to 07/14/2008, to allow DoE to send us funds if they became available during that year. It turned out that we did not receive any funding for the third year. The following paper covers our variable-temperature critical-current measurements. We made transport critical-current (Ic) measurements on commercial multifilamentary Nb3Sn strands at temperatures (T) from 4 to 17 K and magnetic fields (H) from 0 to 14 T. One of the unique features of our measurements is that we can cover a wide range of critical currents from less than 0.1 A to over 700 A.

NTIS

Critical Current; Superconductivity; Niobium Stannides

20100019517 Stanford Univ., Stanford, CA USA

Stanford In-situ High Rate YBCO Process: Transfer to Metal Tapes and Process Scale Up

Beasley, M. R.; Hammond, R. H.; Apr. 14, 2009; 34 pp.; In English

Contract(s)/Grant(s): FC07-03ID14510

Report No.(s): DE2010-951094; DOE/OE-14510; No Copyright; Avail.: National Technical Information Service (NTIS)

The materials science understanding of high rate low cost processes for Coated Conductor will benefit the application to power utilities for low loss energy transportation and power generation as well for DOD applications. The research in this program investigated several materials processing approaches that are new and original, and are not being investigated elsewhere. This work added to the understanding of the material science of high rate PVD growth of HTSC YBCO assisted

by a liquid phase. A new process discovered uses amorphous glassy precursors which can be made at high rate under flexible conditions of temperature and oxygen, and later brought to conditions of oxygen partial pressure and temperature for rapid conversion to YBCO superconductor. Good critical current densities were found, but further effort is needed to optimize the vortex pinning using known artificial inclusions. A new discovery of the physics and materials science of vortex pinning in the HTSC system using Sm in place of Y came at growth at unusually low oxygen pressure resulting in clusters of a low or non superconducting phase within the nominal high temperature phase. The driving force for this during growth is new physics, perhaps due to the low oxygen. This has the potential for high current in large magnetic fields at low cost, applicable to motors, generators and transformers. The technical demands of this project were the motivation for the development of instrumentation that could be essential to eventual process scale up. These include atomic absorption based on tunable diode lasers for remote monitoring and control of evaporation sources (developed under DARPA support), and the utility of Fourier Transform Infrared Reflectivity (FTIR) for aid in the synthesis of complex thin film materials (purchased by a DURIP-AFOSR grant).
NTIS
Coatings; Conductors; Superconductors (Materials); YBCO Superconductors

20100019534 Supergenics I, LLC, Jefferson, MA, USA
Improvement of the Properties of Tubular Internal-Tin Nb3Sn
Gregory, E.; Jan. 2009; 28 pp.; In English
Contract(s)/Grant(s): DE-FG02-07ER84860
Report No.(s): DE2010-946715; DOE/ER-84860; No Copyright; Avail.: National Technical Information Service (NTIS)
Final report of SBIR to develop an economical process that can produce the best material for high field magnets to be used in the next generation of accelerators.
NTIS
High Field Magnets; Particle Accelerators; Superconductors (Materials); Tin

20100019553 Stanford Univ., Stanford, CA USA
Solving Large-Scale Sparse Eigenvalue Problems and Linear Systems of Equations for Accelerator Modeling
Golub, G.; Ko, K.; Mar. 30, 2009; 10 pp.; In English
Contract(s)/Grant(s): FC02-01ER41177
Report No.(s): DE2010-950471; DOE/ER-41177-F; No Copyright; Avail.: National Technical Information Service (NTIS)
The solutions of sparse eigenvalue problems and linear systems constitute one of the key computational kernels in the discretization of partial differential equations for the modeling of linear accelerators. The computational challenges faced by existing techniques for solving those sparse eigenvalue problems and linear systems call for continuing research to improve on the algorithms so that ever increasing problem size as required by the physics application can be tackled. Under the support of this award, the filter algorithm for solving large sparse eigenvalue problems was developed at Stanford to address the computational difficulties in the previous methods with the goal to enable accelerator simulations on then the world largest unclassified supercomputer at NERSC for this class of problems. Specifically, a new method, the Hemitian skew-Hemitian splitting method, was proposed and researched as an improved method for solving linear systems with non-Hermitian positive definite and semidefinite matrices.
NTIS
Eigenvalues; Linear Systems; Particle Accelerators

20100019984 Air Force Research Lab., Wright-Patterson AFB, OH USA
Trapping and Escape of Dislocations in Micro-crystals With External and Internal Barriers (Preprint)
Woodward, Christopher; Dimiduk, Dennis M; Uchic, Michael D; El-Awadya, Jaafar A; Rao, Satish I; Feb 2010; 44 pp.; In English
Contract(s)/Grant(s): Proj-4347
Report No.(s): AD-A519595; AFRL-RX-WP-TP-2010-4160; No Copyright; Avail.: Defense Technical Information Center (DTIC)
We perform three-dimensional dislocation dynamics simulations of solid and annular pillars, having both free surface boundary conditions, or strong barriers at the outer and/or inner surfaces. Both pillar geometries are observed to exhibit a size effect where smaller pillars are stronger. The scaling observed is consistent with the weakest-link activation mechanism and depends on the solid pillar diameter, or the annular pillar effective diameter, Deff= D-Di. An external strong interface is

observed to dramatically increase the dislocation density by an order of magnitude due to trapping dislocations at the interface. In addition, a considerable increase in the flow strength by up to 60% from simulations having free surface boundary conditions is observed. As the applied load increases, weak spots form on the surface of the pillar by dislocations breaking through the interface when the RSS is greater than the barrier strength. The hardening rate is also observed to increase with increasing interface strength.
DTIC
Microcrystals; Single Crystals; Trapping

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20100019018 North Carolina State Univ., Raleigh, NC USA
Label-Free THz-Optoelectronic Sensing of Ultra-Low Concentration of Genetic Sequences: Theoretical Treatment
Zhao, P; Trew, R J; Kelley, C T; Dec 15, 2009; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-04-1-0276
Report No.(s): AD-A518703; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An engineering and mathematics research project is performed to develop the science base and simulation capability for the study, analysis and design of highly-integrated and molecular-based information processing systems. Specifically, this research investigate MQCA architectures as a potential new paradigm for information processing through the development of: (1) detailed models of the interacting molecular-level components, and (2) robust simulation algorithms that are capable of treating phenomenon associated with nonlinear dynamical complexity. Here, it is crucial to understand the interaction between the molecular devices and the substrates. To this connection, we analyze the electrostatic characteristics of the tether atoms connecting organic molecules onto silicon (100) -2 xl surfaces, which is a key factor in the design of molecular devices for information processing and biomolecular sensing. Design principles for silicon surfaces with required electrostatic functionality are presented.
DTIC
Detection; Electro-Optics; Genetics; Quantum Dots

20100019026 Naval Postgraduate School, Monterey, CA USA
Methods for Quantum Circuit Design and Simulation
Weathers, Jeremy M; Mar 2010; 122 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518726; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of quantum computing is to harness the unique properties of quantum mechanics to perform computations that are beyond the capabilities of traditional, classical circuits based on transistors. A quantum circuit is an established way of expressing a quantum algorithm. This thesis will describe the development of a workflow for the design and simulation of quantum circuits, as well as the use of this workflow to express and simulate a set of well-known quantum algorithms. This workflow is also used to simulate and analyze a set of well-known quantum error correction schemes.
DTIC
Algorithms; Circuits; Quantum Theory; Simulation

20100019206 Universal Technology Corp., Dayton, OH USA
Collaborative Research and Development Contract. Delivery Order 0047: Mesocscale Modeling of the Thermal Mechanical Processing (TMP) of Superalloys
Thomas, J. P.; Aug. 2008; 71 pp.; In English
Contract(s)/Grant(s): F33615-03-D-5801-0047; Proj-4349
Report No.(s): AD-A517751; AFRL-RX-WP-TM-2010-4087; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517751

This research in support of the Air Force Research Laboratory Materials and Manufacturing Directorate was conducted at Wright-Patterson AFB, Ohio from 1 March 2006 through 1 February 2008. The work done under this contract belongs to two main types of activities, which decides of the overall outline of this report. First, activities regarding the mesoscale model

of microstructure evolution of Waspaloy will be presented. They consist in few experiments for the validation of hypothesis used to design the model. And they regard its finalization and industrial application. The knowledge gained during this work on Waspaloy provided the basis for a more fundamental type of work which aims at preparing the extension of the modeling tools used for Waspaloy to other alloys as well as to encompass other types of microstructure-evolution models. It is the topic of the second part of this report. It will introduce the prototypical software modules that were designed to demonstrate the feasibility of a next-generation modeling software for microstructure evolution and assess the difficulty of such development.
DTIC
Heat Resistant Alloys; Thermodynamics

20100019704 Rochester Univ., NY USA
Evolution and Survival of Quantum Entanglement
Eberly, J H; Nov 21, 2009; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911NF-05-1-0543
Report No.(s): AD-A519007; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519007

The program of the grant (evolution and survival of quantum entanglement) was advanced by extending to open-system relevance an important lead reported earlier (provided by Jaynes-Cummings closed-system modelling). We report success in tracking the movement of quantum entanglement. Reversals of the entanglement sudden death (ESD) effect are now also open to study in the case of revival effects in coherent-state quantum fields. A new finding is the discovery of a way to hide entanglement completely (reducing concurrence to effectively zero values) for extended periods, but then recover it with manageable loss at later times on a managed schedule. An extended account of work done, with accompanying papers, is attached.
DTIC
Quantum Optics; Quantum Theory; Survival

20100020033 Michigan Univ., Ann Arbor, MI USA
Optically Driven Spin Based Quantum Dots for Quantum Computing
Steel, Duncan G; Sham, L J; Jan 2008; 109 pp.; In English
Contract(s)/Grant(s): W911NF-04-1-0235
Report No.(s): AD-A519735; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This program conducted experimental and theoretical research aimed at developing an optically driven quantum dot quantum computer. In addition to the two co-principal investigators (Sham and Steel), the work was done in collaboration with Dan Gammon at the Naval Research Laboratory. D. Gammon had responsibility for designing, fabricating and basic spectroscopy of the material, LJ Sham is responsible for theoretical support and concept development, and DG Steel is responsible for experimental demonstration of key experimental demonstrations for quantum computing. For this program, qubit is the spin of the electron trapped in a self-assembled quantum dot in InAs. Optical manipulation using the trion state allows for fast (psec) rotations of the electron spin. The program achieved several milestones including demonstration of initialization, fast spin rotations and a phase gate, reduction of nuclear fluctuations extending the spin coherence time by 3 orders of magnitude, major advances in scalable gate proposals, and two proposals for measurement of measurement of true spin coherence time.
DTIC
Quantum Computation; Quantum Dots

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20100020264 National Academy of Sciences - National Research Council, Washington, DC, USA
Capabilities for the Future: An Assessment of NASA Laboratories for Basic Research
[2010]; 17 pp.; In English; Copyright; Avail.: Other Sources

The National Research Council (NRC) selected and tasked the Committee on the Assessment of NASA Laboratory Capabilities to assess the status of the laboratory capabilities of the National Aeronautics and Space Administration (NASA) and to determine whether they are equipped and maintained to support NASA's fundamental research activities. Over the past

5 years or more, there has been a steady and significant decrease in NASA's laboratory capabilities, including equipment, maintenance, and facility upgrades. This adversely affects the support of NASA's scientists, who rely on these capabilities, as well as NASA's ability to make the basic scientific and technical contributions that others depend on for programs of national importance. The fundamental research community at NASA has been severely impacted by the budget reductions that are responsible for this decrease in laboratory capabilities, and as a result NASA's ability to support even NASA's future goals is in serious jeopardy. This conclusion is based on the committee's extensive reviews conducted at fundamental research laboratories at six NASA centers (Ames Research Center, Glenn Research Center, Goddard Space Flight Center, the Jet Propulsion Laboratory, Langley Research Center, and Marshall Space Flight Center), discussions with a few hundred scientists and engineers, both during the reviews and in private sessions, and in-depth meetings with senior technology managers at each of the NASA centers.
Derived from text
Laboratories; NASA Programs; Research Facilities; Research and Development; Maintenance

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20100018382 Elizabeth City State Univ., NC, USA
Transportation Informtion Needs Assessment for Small Rural Municipalities in Eastern North Carolina
Bradshaw, Scott D.; Adams, Reed; Worthington, Michael; February 17, 2006; 80 pp.; In English
Contract(s)/Grant(s): Proj. No. 2005-27
Report No.(s): PB2010-105925; No Copyright; Avail.: National Technical Information Service (NTIS)

The many small towns in North Carolina (1,000 residents or fewer) face a number of disadvantages and unique problems when trying to address their transportation-related needs. This project addressed these problems in two primary ways. First, we developed a resource containing basic contact information along with census data regarding demographic, economic, and social characteristics of each town. Second, a mail survey was sent to all of the towns to determine the mayors' satisfaction with NCDOT. Regional meetings were then held with the mayors to gain a deeper understanding of their experiences. While the majority of the mayors reported satisfaction with their transportation services, a sizeable percentage expressed dissatisfaction. Satisfaction varied depending upon characteristics of the towns. Mayors also reported more satisfaction and more contact with NCDOT and their district office than with their RPO or County Commissioner. The mayors reported needing and wanting help with numerous transportation-related issues in their town. In meetings, mayors reported a number of immediate concerns (highway maintenance, safety, drainage, and highway signs) with limited time and resources to consider longer-term issues. Many mayors described NCDOT as an inefficient bureaucracy that largely ignored their problems. When NCDOT did turn its attention to the small towns, according to the mayors, they excluded the mayor and town officials from the process. The problems are made worse by the mayors admitted lack of information about the operation of NCDOT and their general lack of time and other resources to put toward the problems. To address these problems, efforts should be focused on addressing the way NCDOT interacts with the small towns to increase both efficiency and to improve the perception of fairness. Research should continue into how to improve the organizational infrastructure and operations of NCDOT. The needs of the small towns could be served through the establishment of a small town transportation institute that would serve as a resource for the small towns and as a partner to work with both the towns and NCDOT.
NTIS
North Carolina; Transportation; Highways; Surveys; Drainage; Maintenance

20100018465 Government Accountability Office, Washington, DC, USA
Information Security: IRS Needs to Continue to Address Significant Weaknesses
March 2010; 30 pp.; In English
Report No.(s): PB2010-105946; GAO-10-355; No Copyright; Avail.: CASI: A03, Hardcopy

The Internal Revenue Service (IRS) relies extensively on computerized systems to carry out its demanding responsibilities to collect taxes, process tax returns, and enforce the nation's tax laws. Effective information security controls are essential to protect financial and taxpayer information from inadvertent or deliberate misuse, improper disclosure, or destruction. As part of its audit of IRS's fiscal years 2009 and 2008 financial statements, GAO assessed (1) the status of IRS's actions to correct or mitigate previously reported information security weaknesses and (2) whether controls over key financial and tax processing

systems are effective in ensuring the confidentiality, integrity, and availability of financial and sensitive taxpayer information. To do this, GAO examined IRS information security policies, plans, and procedures; tested controls over key financial applications; and interviewed key agency officials at six sites.
NTIS
Revenue; Security

20100018488 Texas A&M Univ., College Station, TX USA
Analysis and Integration of Spatial Data for Transportation Planning
Quiroga, Cesar; Li, Yingfeng; Koncz, Nicholas; Overman, John; June 2009; 120 pp.; In English
Contract(s)/Grant(s): Proj. No. 0-5696
Report No.(s): PB2010-106825; FHWA/TX-09/0-5696-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Transportation planning requires substantial amounts of data and cooperation among transportation planning agencies. Advances in computer technology and the increasing availability of geographic information systems (GIS) are giving transportation planners the ability to develop and use data with a much higher degree of efficiency. However, as information systems advance, the need to provide effective data integration/exchange protocols and procedures to reduce redundancy and data collection costs is becoming more important. Many factors influence the effectiveness of data exchange and data integration efforts, such as data compatibility, data access, data quality, completeness, metadata, hardware, software, and staff expertise. This research resulted in a catalog of spatial data sources available to transportation planning agencies in Texas. The work included a synthesis of current transportation planning practices in Texas with a focus on spatial data integration and exchange issues, meetings with transportation planning and data stakeholders, the development of a map of data sources, the development of a preliminary logical data model of spatial data entities, and a compilation of metadata documents for a sample of data sources. Developing the catalog of categories and subcategories for transportation planning spatial data was an iterative process that involved several rounds of data entity categorization; analysis of the resulting structure for inconsistencies, gaps, and redundancies; and subsequent changes to the data entity categorization scheme. In the end, the three-level grouping structure resulted in 7 categories, 63 subcategories, and 589 spatial data entities. The research also resulted in a prototype web-based map and metadata viewer called Transportation Planning GIS (TPGIS) Data Viewer.
NTIS
Planning; Transportation

20100018514 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Establishing Requirements for Information Gathering Tasks
Amin, A. K.; January 2009; 8 pp.; In English
Report No.(s): PB2010-107140; INS-E0905; Copyright; Avail.: National Technical Information Service (NTIS)

This PhD project aims at understanding and supporting the complex activities of information gathering. To date, most search applications support one aspect of search namely low-level keyword-based search to find documents. However, in reality, users search tasks are often high-level search tasks, such as comparing differences between art objects. Thus, there is a mismatch between the users search needs and the available search tools. This research investigates information gathering characteristics and how alternative search interfaces could support them. Design recommendations and guidelines for interfaces to support information gathering will be designed and verified through lab experiments and evaluation in different domains.
NTIS
Data Acquisition; Information Retrieval

20100018516 Newcastle-upon-Tyne Univ., Newcastle, UK
Proceedings of the First Deploy Technical Workshop
Jastram, M.; Laibinis, L.; Losch, F.; Mazzara, M.; January 2010; 212 pp.; In English
Report No.(s): PB2010-106109; CS-TR-1187; Copyright; Avail.: National Technical Information Service (NTIS)

The second DEPLOY annual plenary meeting was held from 21st to 23rd of October in Aix-en-Provence, France. The main difference with respect to the first meeting has been a significant amount of time dedicated to technical presentations of papers. We invited all the academic and industrial partners to submit papers about the work they were carrying on inside the DEPLOY project. The accepted submissions have been then organized in five different sessions, each regarding a DEPLOY relevant topic, plus one for short papers. The structure of this document reflects exactly the structure of the workshop, each

of the parts represents a workshop session: 1. Event-B and Extensions 2. Code Generation 3. Event-B Metrics and Tools 4. Model Checking 5. Business Information Systems 6. Short Papers.
NTIS
Conferences; Information Systems

20100018610 Carnegie-Mellon Univ., Pittsburgh, PA USA
Pairwise Document Classification for Relevance Feedback
Elsas, Jonathan L; Donmez, Pinar; Callan, Jamie; Carbonell, Jaime G; Nov 2009; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517685; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517685

In this paper we present Carnegie Mellon University's submission to the TREC 2009 Relevance Feedback Track. In this submission we take a classification approach on document pairs to using relevance feedback information. We explore using textual and non-textual document-pair features to classify unjudged documents as relevant or non-relevant, and use this prediction to re-rank a baseline document retrieval. These features include co-citation measures, URL similarities, as well as features often used in machine learning systems for document ranking such as the difference in scores assigned by the baseline retrieval system.
DTIC
Classifications; Feedback

20100018611 University Coll., Dublin, Ireland
UCD SIFT in the TREC 2009 Web Track
Lillis, David; Toolan, Fergus; Lin, Ling; Collier, Rem W; Dunnion, John; Nov 2009; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517686; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517686

The SIFT (SIFT Information Fusion Techniques) group in UCD is dedicated to researching Data Fusion in Information Retrieval. This area of research involves the merging of multiple sets of results into a single result set that is presented to the user. As a means of evaluating the effectiveness of this work, the group entered Category B of the TREC 2009 Web Track. This paper discusses the strategies and experiments employed by the UCD SIFT group in entering the TREC Web Track 2009. This involved the use of freely-available Information Retrieval tools to provide inputs to the data fusion process, with the aim of contrasting with more sophisticated systems.
DTIC
Information Retrieval; Multisensor Fusion

20100018613 Amsterdam Univ., Netherlands
Topical Diversity and Relevance Feedback
Meij, Edgar; He, Jiyin; Weerkamp, Wouter; de Rijke, Maarten; Nov 2009; 5 pp.; In English
Report No.(s): AD-A517688; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517688

We describe the participation of the University of Amsterdam's Intelligent Systems Lab in the relevance feedback track at TREC 2009. Our main conclusion for the relevance feedback track is that a topical diversity approach provides good feedback documents. Further, we find that our relevance feedback algorithm seems to help most when there are sufficient relevant documents available.
DTIC
Feedback; Information Retrieval

20100018614 Amsterdam Univ., Netherlands
Overview of the TREC 2009 Entity Track
Balog, Krisztian; Vries, Arjen P de; Serdyukov, Pavel; Thomas, Paul; Westerveld, Thijs; Nov 2009; 11 pp.; In English
Report No.(s): AD-A517699; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517699

The goal of the entity track is to perform entity-oriented search tasks on the World Wide Web. Many user information

needs would be better answered by specific entities instead of just any type of documents. The track defines entities as typed search results, things, represented by their homepages on the web. Searching for entities thus corresponds to ranking these homepages. The track thereby investigates a problem quite similar to the QA list task. In this pilot year, we limited the track's scope to searches for instances of the organizations, people, and product entity types.
DTIC
Information Retrieval; Internets

20100018617 Amsterdam Univ., Netherlands
Heuristic Ranking and Diversification of Web Documents
He, Jiyin; Balog, Krisztian; Hofmann, Katja; Meij, Edgar; Rijke, Maarten de; Tsagkias, Manos; Weerkamp, Wouter; Nov 2009; 6 pp.; In English
Report No.(s): AD-A517703; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517703

We describe the participation of the University of Amsterdam's Intelligent Systems Lab in the web track at TREC 2009. We participated in the ad hoc and diversity task. We find that spam is an important issue in the ad hoc task and that Wikipedia-based heuristic optimization approaches help to boost the retrieval performance, which is assumed to potentially reduce spam in the top ranked results. As for the diversity task, we explored different methods. Clustering and a topic model-based approach have a similar performance and both are relatively better than a query log based approach.
DTIC
Heuristic Methods; Information Retrieval; Internets; Ranking

20100018618 Amsterdam Univ., Netherlands
Related Entity Finding Based on Co-Occurrence
Bron, Marc; Balog, Krisztian; Rijke, Maarten de; Nov 2009; 5 pp.; In English
Report No.(s): AD-A517706; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517706

We report on experiments for the Related Entity Finding task in which we focus on only using Wikipedia as a target corpus in which to identify (related) entitities. Our approach is based on co-occurrences between the source entity and potential target entities. We observe improvements in performance when a context-independent co-occurrence model is combined with context-dependent co-occurrence models in which we stress the importance of the expected relation between source and target entity. Applying type filtering yields further improvements results.
DTIC
Data Processing; Ranking; Texts

20100018619 Army War Coll., Carlisle Barracks, PA USA
Military-Media Relations Come of Age
Willey, Barry E; Mar 1989; 10 pp.; In English
Report No.(s): AD-A517712; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517712

We have now run the gamut-from a hasty, makeshift pool, organized to cover the latter part of the Grenada rescue operation; through training deployments and the activation of the DoD national media pool for the first transit of reflagged Kuwaiti tankers; to the first employment of the DoD media pool during hostile action by U.S. forces, a thoroughly planned contingency that involved public affairs from the beginning as an integral part of the operation. Regional pool activities ceased in the Gulf in July of last year. In its place, a program of unilateral embarkations began to accommodate the many requests received from news organizations asking for the opportunity to send representatives to ships in the Persian Gulf. Of course, the Department of Defense and U.S. Central Command retain the option of reactivating the pool, should that become necessary. The military's planning, coordination, and execution of the media pool deployments to cover operations in the Persian Gulf and elsewhere have set the standard for future media pool operations. The evolution of pool deployments to cover both ground-based force deployments during training and contingency operations and sea-based deployments in the Persian Gulf involving all services has clearly addressed the Sidle Panel's statement of principle -- US news media [should] cover US military operations to the maximum degree possible consistent with mission security and the safety of US forces.
DTIC
Defense Program; Military Operations; News Media; Policies

20100018620 Technische Hogeschool, Delft, Netherlands

Delft University at the TREC 2009 Entity Track: Ranking Wikipedia Entities

Serdyukov, Pavel; de Vries, Arjen; Nov 2009; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517713; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517713

Entity ranking is a novel TREC task introduced this year and posing challenges similar to those already well-known in web retrieval research community. We present a system which leverages a number of popular web retrieval techniques, utilizes existing knowledge bases and relies on various task-specific heuristics to produce high quality runs. Since we had no training queries with relevant web-pages contained in Category B part of ClueWeb09 collection, we focused on using various strategies rather than on using one kind of approach with different parameter settings. However, in three of four submitted runs we treated Wikipedia part of the collection as the main source of evidence about relevance of entities that can be found on the Web.

DTIC

Data Processing; Information Retrieval; Internets; Knowledge Based Systems; Ranking

20100018621 Universidade Faculdade de Engenharia, Porto, Portugal

FEUP at TREC 2009 Blog Track: Temporal Evidence in the Faceted Blog Distillation Task

Nunes, Sergio; Ribeiro, Cristina; David, Gabriel; Nov 2009; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517714; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517714

This paper describes the participation of FEUP, from the University of Porto, in the TREC 2009 Blog Track. FEUP participated in the faceted blog distillation task with work focused on the use of temporal features available in the new TREC Blogs08 collection. The approach presented in this paper uses the temporal information available in most individual posts to amplify (or reduce) each post's score. Blog scores, and subsequent ranks, are obtained by combining individual posts' scores. While preparing the runs, no endeavors were made to identify a priori any temporal differences between the three distinct facets.

DTIC

Data Processing; Distillation; Information Retrieval; Internets

20100018622 Fudan Univ., Shanghai, China

Relevance Feedback based on Constrained Clustering: FDU at TREC 09

Wang, Bingqing; Huang, Xuanjing; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517715; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517715

We introduce our participation of the TREC Relevance Feedback(RF) TRACK in 2009. The RF09 TRACK is focused on the explicit relevant feedback, where a few relevant and irrelevant documents are available to each query. Our system is implemented under the framework of probabilistic language model. We apply the constrained clustering on the top returned documents and extract the expanded words to reform the query. We also extract the named entities from the explicit relevant documents to expand the query. The experiment was conducted on the ClueWeb09 TREC Category B, which is a new and huge test collection for the TREC TRACKs. The evaluation result shows the performance of the constrained clustering.

DTIC

Feedback; Information Retrieval; Internets; Radio Frequencies

20100018623 Arkansas Univ., Little Rock, AR USA

A Journey in Entity Related Retrieval for TREC 2009

Pamarthi, Jagadish; Zhou, Guangxu; Bayrak, Coskun; Nov 2009; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517716

The focus of this paper is to present the results obtained as a result of performing entity information retrieval, namely the home pages of products, organizations and persons. The preliminary results, based on the Indri Search Engine, of this study and experimentation were presented at the Entity Track in TREC 2009. Indri Search Engine is an efficient and effective open

source tool, which is operated by Indri query language in any windows or UNIX based platform. Indri is based on the inference network framework and supports structured queries.
DTIC
Information Retrieval; Internets

20100018624 Purdue Univ., West Lafayette, IN USA
Strategies for Effective Chemical Information Retrieval
Cetintas, Suleyman; Si, Luo; Nov 2009; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NSF-IIS-0746830
Report No.(s): AD-A517717; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517717

We participated in the technology survey and prior art search subtasks of the TREC 2009 Chemical IR Track. This paper describes the methods developed for these two tasks. For the technology survey task, we propose a method that constructs highly structured queries to do retrieval on different fields of chemical patents and documents in a weighted way. The proposed method i) enriches these structured queries with synonyms of the chemicals that have been identified, and ii) uses simple entity recognition to extract information for increasing or decreasing weights of some terms and to filter out documents from the ranked list. For prior art search task; we propose an automated query generation method that uses all title words, and selects sets of terms from the claims, abstract and description fields of query patents to transform a query patent into a search query. From the selected terms, chemical entities are extracted and synonyms for the identified chemical entities are included from PubChem. Then structured queries are formed to do retrieval over different fields of documents with different weights. Furthermore a post-processing step is also proposed that i) filters out some of the retrieved documents from the ranked list because of date constraints and ii) utilizes the IPC similarities between query patent and its retrieved patents to re-rank the retrieved documents. Empirical results demonstrate the effectiveness of these methods in both tasks.
DTIC
Information Retrieval; Internets; Patents

20100018625 Beijing Inst. of Tech., China
BIT at TREC 2009 Faceted Blog Distillation Task
Jiang, Peng; Yang, Qing; Zhang, Chunxia; Niu, Zhendong; Nov 2009; 8 pp.; In English
Contract(s)/Grant(s): 60705022
Report No.(s): AD-A517718; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517718

This Paper presents the work done for the TREC 2009 faceted blog distillation task of blog track. In our approach, we use a mixture of language models based on global representation. Our model can be regarded as a combination of topic relevance model and faceted relevance model. By pseudorelevance feedback method, we can estimate the above two models from topic relevance feedback documents and facet relevance feedback documents respectively. Experimental results on TREC blogs08 collection show the effectiveness of our proposed approach.
DTIC
Distillation; Information Retrieval; Internets

20100018626 Academia Sinica, Beijing, China
ICTNET at Web Track 2009 Diversity task
Bi, Wenjing; Yu, Xiaoming; Liu, Yue; Guan, Feng; Peng, Zeying; Xu, Hongbo; Cheng, Xueqi; Nov 2009; 5 pp.; In English
Report No.(s): AD-A517721; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517721

We (ICTNET team) participated in Web Track of TREC2009, and in this paper, we summarize our work on Diversity task of Web Track, which is new in this year. The goal of the diversity task is to return a ranked list of pages that together provide complete coverage for a query, while avoiding excessive redundancy in the result list. For this task, we cluster the results of ad hoc task, and rerank the results depend on subtopics docs covers. Besides, we introduce two methods which tried to find the implicit subtopic by using the docs returned from commerce search engine.
DTIC
Information Retrieval; Internets

20100018627 Beijing Univ. of Posts and Telecommunications, Beijing, China
PRIS at 2009 Relevance Feedback track: Experiments in Language Model for Relevance Feedback
Li, Si; Li, Xinsheng; Zhang, Hao; Gao, Sanyuan; Chen, Guang; Guo, Jun; Nov 2009; 6 pp.; In English
Report No.(s): AD-A517722; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517722

This paper describes BUPT (pris) participation in Relevance Feedback Track 2009. The track has two phrases. In the first phrase, 5 documents are submitted based on the results of the k-means. In the second phrase, language model is used to relevance feedback for query expansion.
DTIC
Feedback; Information Retrieval; Internets

20100018628 Beijing Univ. of Posts and Telecommunications, Beijing, China
A Study of Faceted Blog Distillation -- PRIS at TREC 2009 Blog Track
Li, Si; Gao, Huiji; Gao, Juiji; Sun, Hao; Chen, Fei; Feng, Oupeng; Gao, Sanyuan; Zhang, Hao; Li, Xinsheng; Tan, Caili; Xu, Weiran; Chen, Guang; Guo, Jun; Nov 2009; 8 pp.; In English
Report No.(s): AD-A517723; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517723

This paper describes BUPT (pris) participation in faceted blog distillation task at Blog Track 2009. The system adopts a two-stage strategy in faceted blog distillation task. In the first stage, the system carries out a basic topic relevance retrieval to get the top k blogs for each query. In the second stage, different models are designed to judge the facets and ranking.
DTIC
Distillation; Information Retrieval; Internets

20100018630 Academia Sinica, Beijing, China
A Novel Framework for Related Entities Finding: ICTNET at TREC 2009 Entity Track
Zhai, Haijun; Cheng, Xueqi; Guo, Jiafeng; Xu, Hongbo; Liu, Yue; Nov 2009; 4 pp.; In English
Report No.(s): AD-A517725; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517725

This paper addresses the problem of related entity finding, which was proposed in trec 2009. The overall aim of related entity finding (REF) is to perform entity-related search on Web data, which address common information needs that are not that well modeled as ad hoc document search. In this paper, a novel framework was proposed based on a probabilistic model for related entity finding in a Web collection. This model consists of two parts. One is the probability indicating the relation between the source entity and the candidate entities. The other is the probability indicating the relevance between the candidate entities and the topic. Using ClueWeb09 dataset, the experimental evaluations show the effectiveness of our REF framework.
DTIC
Information Retrieval; Internets

20100018631 Peking Univ., China
PARADISE Based Search Engine at TREC 2009 Web Track
Shan, Dongdong; Zhao, Dongsheng; He, Jing; Yan, Hongfei; Nov 2009; 5 pp.; In English
Report No.(s): AD-A517729; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517729

In this paper, we introduce the PARADISE search engine in TREC09 Web track. PARADISE is the abbreviation for Platform for Applying, Research and Developing Intelligent Search Engine, which is a search engine platform developed by SEWM group, Peking University. The system is designed to support both English and Chinese information retrieval. This system preprocessed and indexed the five hundred million web pages for this year's Web Track. In the preprocessing stage, the templates were removed, the encoding were identified and unified, and the anchor texts and InLink information are extracted with the mapreduce framework (using Hadoop in this system). In retrieval, our runs used an extension of BM25. This model distinguishes terms from different fields and integrated both term counts and position information. Furthermore, some web based features are also considered.
DTIC
Information Retrieval; Internets; Textbooks

20100018632 Beijing Inst. of Tech., China

Experiments on Related Entity Finding Track at TREC 2009

Yang, Qing; Jiang, Peng; Zhang, Chunxia; Niu, Zhendong; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517730; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517730

Our goal in participating in the TREC 2009 Entity Track is to study whether QA list technique can help improve accuracy of the entity finding task. Also, we take a looking for homepage finding to identify homepages of an entity by training a maximum entropy classifier and a logistic regression models for three types of entity respectively.

DTIC

Information Retrieval; Internets; Regression Analysis

20100018633 Alaska Univ., Anchorage, AK USA

Lucene for n-grams using the ClueWeb Collection

Newby, Gregory B; Fallen, Chris; McCormick, Kylie; Nov 2009; 8 pp.; In English

Report No.(s): AD-A517732; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517732

The ARSC team made modifications to the Apache Lucene engine to accommodate go words, taken from the Google Gigaword vocabulary of n-grams. Indexing the Category B subset of the ClueWeb collection was accomplished by a divide and conquer method, working across the separate ClueWeb subsets for 1, 2 and 3-grams.

DTIC

Information Retrieval; Internets

20100018634 Microsoft Research, Redmond, WA USA

Microsoft Research at TREC 2009. Web and Relevance Feedback Tracks

Craswell, Nick; Fetterly, Dennis; Najork, Marc; Robertson, Stephen; Yilmaz, Emine; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517733; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517733

We took part in the Web and Relevance Feedback tracks, using the ClueWeb09 corpus. To process the corpus, we developed a parallel processing pipeline which avoids the generation of an inverted file. We describe the components of the parallel architecture and the pipeline and how we ran the TREC experiments, and we present effectiveness results.

DTIC

Feedback; Information Retrieval; Internets; Parallel Processing (Computers)

20100018635 Academia Sinica, Beijing, China

ICTNET at Blog Track TREC 2009

Xu, Xueke; Liu, Yue; Xu, Hongbo; Yu, Xiaoming; Song, Linhai; Guan, Feng; Peng, Zeying; Cheng, Xueqi; Nov 2009; 6 pp.; In English

Report No.(s): AD-A517734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517734

This paper describes our participation in blog track of TREC2009. All runs are submitted for both two task, namely Top stories identification task and faceted blog distillation task. The FirteX platform was used to index and retrieval posts. As for top stories identification task, to identify important headlines, we measure the importance of headline by accumulating the BM25 relevance score with posts on the query day. We propose a graph-based iterative approach and a sub-topic detecting based approach respectively to identify diverse blog posts. As for faceted blog distillation task: we adopt a very straightforward approach and measure the topical relevance by only exploiting top ad-hoc 10000 posts. To identify facet inclination, we either train centroid classifier or compute facet inclination weights of terms to compute facet inclination score and rerank feed by combining relevance score and facet inclination score.

DTIC

Conferences; Information Retrieval; Internets; Texts

20100018636 Sheffield Univ., UK

Northeastern University in TREC 2009. Million Query Track

Kanoulas, Evangelos; Dai, Keshi; Pavlu, Virgil; Savev, Stefan; Aslam, Javed; Nov 2009; 7 pp.; In English

Report No.(s): AD-A517738; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517738

Ranking is a central problem in information retrieval. Modern search engines, especially those designed for the World Wide Web, commonly analyze and combine hundreds of features extracted from the submitted query and underlying documents in order to assess the relative relevance of a document to a given query and thus rank the underlying collection. The sheer size of this problem has led to the development of learning to rank (LTR) algorithms that can automate the construction of such ranking functions: Given a training set of (feature vector, relevance) pairs, a machine learning procedure learns how to combine the query and document features in such a way so as to effectively assess the relevance of any document to any query and thus rank a collection in response to a user input. Much thought and research has been placed on the development of sophisticated learning-to-rank algorithms. However, relatively little research has been conducted on the construction of appropriate learning to rank data sets nor on the effect of these data sets on the ability of a learning-to-rank algorithm to learn effectively.

DTIC

Conferences; Information Retrieval; Machine Learning; Statistical Analysis; Texts

20100018637 Pohang Univ. of Science and Technology, Pohang, Korea, Republic of

POSTECH at TREC 2009 Blog Track: Top Stories Identification

Lee, Yeha; Jung, Hun-young; Song, Woosang; Lee, Jong-Hyeok; Nov 2009; 8 pp.; In English

Report No.(s): AD-A517740; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517740

This paper describes our participation in the TREC 2009 Blog Track. Our system consists of the query likelihood component and the news headline prior component, based on the language model framework. For the query likelihood, we propose several approaches to estimate the query language model and the news headline language model. We also suggest two approaches to choose the 10 supporting relevant posts: Feed-Based Selection and Cluster-Based Selection. Furthermore, we propose two criteria to estimate the news headline prior for a given day. Experimental results show that using the prior significantly improves the performance of the task.

DTIC

Information Retrieval; Internets

20100018638 Purdue Univ., West Lafayette, IN USA

Entity Retrieval by Hierarchical Relevance Model, Exploiting the Structure of Tables and Learning Homepage Classifiers

Fang, Yi; Si, Luo; Yu, Zhengtao; Xian, Yantuan; Xu, Yangbo; Nov 2009; 7 pp.; In English

Contract(s)/Grant(s): NSF-IIS-0746830

Report No.(s): AD-A517741; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517741

This paper gives an overview of our work done for the TREC 2009 Entity track. We propose a hierarchical relevance retrieval model for entity ranking. In this model, three levels of relevance are examined which are document, passage and entity, respectively. The final ranking score is a linear combination of the relevance scores from the three levels. Furthermore, we exploit the structure of tables and lists to identify the target entities from them by making a joint decision on all the entities with the same attribute. To find entity homepages, we train logistic regression models for each type of entities. A set of templates and filtering rules are also used to identify target entities. The key lessons that we learned by participating this year's Entity track include: 1) our special treatment of table and list data is well rewarding; 2) The high accuracy of homepage finding is crucial in this track; 3) Wikipedia can serve as a valuable knowledge resource for different aspects of the related entity finding task.

DTIC

Classifiers; Information Retrieval; Internets

20100018639 Army Research Lab., White Sands Missile Range, NM USA
Experiments with the Negotiated Boolean Queries of the TREC 2009 Legal Track
Tomlinson, Stephen; Feb 2, 2010; 12 pp.; In English
Report No.(s): AD-A517742; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517742

For our participation in the Batch Task of the TREC 2009 Legal Track, we produced several retrieval sets to compare experimental Boolean, vector, fusion and relevance feedback techniques for e-Discovery requests. In this paper, we have reported not just the mean scores of the experimental approaches but also the largest per-topic impacts of the techniques for several measures. The experimental automatic relevance feedback technique was found to attain a statistically significant gain over the reference Boolean result in both the mean Precision\@B and F1\@K measures.
DTIC
Boolean Algebra; Information Retrieval

20100018640 Wisconsin Univ., Milwaukee, WI USA
TREC Chemical IR Track 2009: A Distributed Dimensional Indexing Model for Chemical Patent Search
Urbain, Jay; Frieder, Ophir; Nov 2009; 7 pp.; In English
Report No.(s): AD-A517743; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517743

For the TREC-2009 Chemical IR Track, we explore development of a distributed information retrieval system based on a dimensional data model. The indexing model supports named entity identification and aggregation of term statistics at multiple levels of patent structure including individual words, sentences, claims, descriptions, abstracts, and titles. The system was deployed across 15 Amazon Web Services (AWS) Elastic Cloud Compute (EC2) instances and 15 Elastic Block Storage (EBS) database shards to support efficient indexing and query processing of the relatively large index generated from indexing each individual word (sans stop words) in the 100G+ collection of chemical patent documents. The query processing algorithm for technology survey search and prior art search uses information extraction techniques and locally aggregated term statistics to help disambiguate candidate entities and terms in context. Query processing for prior art search automatically generates a structured query based on the relative distinctiveness of individual terms and candidate entity phrases from the query patent's claims, abstract, and title sections. For both the technology survey and prior art search, we evaluated several probabilistic retrieval functions for integrating statistics of retrieved named entities with term statistics at multiple levels of document structure to identify relevant patents.
DTIC
Information Retrieval; Patents

20100018641 Royal Melbourne Inst. of Tech., Australia
RMIT University at TREC 2009: Web Track
Garcia, Steven; Nov 2009; 4 pp.; In English
Report No.(s): AD-A517749; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517749

RMIT participated in the 2009 Web Track tasks. Our submissions utilised the Zettair search engine to index and search the Category B subset of the ClueWeb collection used by the Web Track. The Web Track was composed of two tasks, a traditional adhoc retrieval task, and a new diversity task where participants attempted to retrieve documents covering a range of sub topics for each query. Sub topics were not provided with the queries. Our experiments utilised the well known measures Okapi BM25 and language modeling with Dirichlet smoothing for the adhoc task. For the diversity task we attempted to improve the diversity of query results by minimising the number of documents returned for a single domain. Runs were generated using a customised version of the Zettair search engine which was adapted to deal with the large scale ClueWeb collection.
DTIC
Information Retrieval; Queueing Theory

20100018643 Glasgow Univ., UK
University of Glasgow at TREC 2009: Experiments with Terrier
McCreadie, Richard; MacDonald, Craig; Ounis, Iadh; Peng, Jie; Santos, Rodrygo L; Nov 2009; 11 pp.; In English
Report No.(s): AD-A517757; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517757

In TREC 2009, we extend our Voting Model for the faceted blog distillation, top stories identification, and related entity

finding tasks. Moreover, we experiment with our novel xQuAD framework for search result diversification. Besides fostering our research in multiple directions, by participating in such a wide portfolio of tracks, we further develop the indexing and retrieval capabilities of our Terrier Information Retrieval platform, to effectively and efficiently cope with a new generation of large-scale test collections.
DTIC
Information Retrieval; Internets; Terrier Missile

20100018645 Microsoft Research Asia, Beijing, China
Microsoft Research Asia at the Web Track of TREC 2009
Dou, Zhicheng; Chen, Kun; Song, Ruihua; Ma, Yunxiao; Shi, Shuming; Wen, Ji-Rong; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517765; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517765

In TREC 2009, we participate in the Web track, and focus on the diversity task. We propose to diversify web search results by first mining subtopics, and then rank results based on mined subtopics. We propose a model to diversify search results by considering both relevance of documents and richness of mined subtopics. Our experimental results show that the model improves diversity of search results in terms of NDCG, and combining subtopics from multiple data sources helps further improve result diversity.
DTIC
Asia; Information Retrieval; Internets; Texts

20100018646 Delaware Univ., Newark, DE USA
UDEL/SMU at TREC 2009 Entity Track
Zheng, Wei; Gottipati, Swapna; Jiang, Jing; Fang, Hui; Nov 2009; 10 pp.; In English
Report No.(s): AD-A517766; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517766

We report our methods and experiment results from the collaborative participation of the InfoLab group from University of Delaware and the school of Information Systems from Singapore Management University in the TREC 2009 Entity track. Our general goal is to study how we may apply language modeling approaches and natural language processing techniques to the task. Specifically, we proposed to find supporting information based on segment retrieval, to extract entities using Stanford NER tagger, and to rank entities based on a previously proposed probabilistic framework for expert finding.
DTIC
Information Retrieval; Models; Natural Language (Computers); Texts

20100018647 York Univ., Downsview, Ontario Canada
Overview of the TREC 2009 Chemical IR Track
Lupu, Mihai; Piroi, Florina; Huang, Xiangji; Zhu, Jianhan; Tait, John; Nov 2009; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517769; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517769

TREC 2009 was the first year of the Chemical IR Track, which focuses on evaluation of search techniques for discovery of digitally stored information on chemical patents and academic journal articles. The track included two tasks: Prior Art (PA) and Technical Survey (TS) tasks. This paper describes how we designed the two tasks and presents the official results of eight participating groups.
DTIC
Patents; Texts

20100018648 Saskatchewan Univ., Saskatoon, Saskatchewan Canada
Sparse Matrix Factorization: Applications to Latent Semantic Indexing
Moulding, Erin; Kontostathis, April; Spiteri, Raymond J; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517770; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517770

This article describes the use of Latent Semantic Indexing (LSI) and some of its variants for the TREC Legal batch task.

Both folding-in and Essential Dimensions of LSI (EDLSI) appeared as if they might be successful for recall-focused retrieval on a collection of this size. Furthermore, we developed a new LSI technique, one which replaces the Singular Value Decomposition (SVD) with another technique for matrix factorization, the sparse column-row approximation (SCRA). We were able to conclude that all three LSI techniques have similar performance. Although our 2009 results showed significant improvement when compared to our 2008 results, the use of a better method for selection of the parameter K, which is the ranking that results in the best balance between precision and recall, appears to have provided the most benefit.
DTIC
Indexes (Documentation); Information Retrieval; Large Scale Integration; Matrices (Mathematics); Subjects

20100018649 Lugano Univ., Switzerland
University of Lugano at TREC 2009 Blog Track
Keikha, Mostafa; Carman, Mark; Gwadera, Robert; Gerani, Shima; Markov, Ilya; Inches, Giacomo; Alidin, Az A; Crestani, Fabio; Nov 2009; 8 pp.; In English
Report No.(s): AD-A517774; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517774

We report on the University of Lugano's participation in the Blog track of TREC 2009. In particular we describe our system for performing blog distallation, faceted search and top stories identification.
DTIC
Information Retrieval; Texts

20100018650 Massachusetts Univ., Amherst, MA USA
UMass Amherst and UT Austin \@ The TREC 2009 Relevance Feedback Track
Cartright, Marc-Allen; Seo, Jangwon; Lease, Matthew; Nov 2009; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): OISE-0530118
Report No.(s): AD-A517782; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517782

We present a new supervised method for estimating term-based retrieval models and apply it to weight expansion terms from relevance feedback. While previous work on supervised feedback [Cao et al., 2008] demonstrated significantly improved retrieval accuracy over standard unsupervised approaches [Lavrenko and Croft, 2001, Zhai and Laerty, 2001], feedback terms were assumed to be independent in order to reduce training time. In contrast, we adapt the AdaRank learning algorithm [Xu and Li, 2007] to simultaneously estimate parameterization of all feedback terms. While not evaluated here, the method can be more generally applied for joint estimation of both query and feedback terms. To apply our method to a large web collection, we also investigate use of sampling to reduce feature extraction time while maintaining robust learning.
DTIC
Conferences; Feedback; Information Retrieval; Texts

20100018660 Naval Observatory, Washington, DC USA
High-Performance RF Optical Links
Crane, Scott; Ekstrom, Christopher R; Koppang, Paul A; Walls, Warren F; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517804; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517804

Transferring a master reference signal across a research campus or even across a region is a key activity for a timing facility. In the past, the U.S. Naval Observatory (USNO) has used techniques ranging from coaxial cables to basic fiber links to transfer 5 MHz Master Clock signals. Recently, USNO installed new fiber runs on its campus, along with newly designed laser modules. Several months of data have now been collected with the new transceivers driving these inter-building fiber links. The modules were also tested in an environmental chamber to evaluate their temperature sensitivities. The laser modules alone show more than a factor of 10 improvement over previous transceivers used at USNO. We are also investigating actively stabilized laser links to further improve our ability to transfer Master Clock signals.
DTIC
Information Transfer; Radio Frequencies

20100018662 Tsinghua Univ., Bejing, China

THUIR at TREC 2009 Web Track: Finding Relevant and Diverse Results for Large Scale Web Search

Li, Z C; Chen, F; Xing, Q L; Miao, J W; Xue, Y F; Zhu, T; Zhou, B; Chen, R W; Liu, Y Q; Zhang, M; Jin, Y; Ma, S P; Nov 2009; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517807; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517807

This is the 8th year that IR group of Tsinghua University (THUIR) participates in TREC. This year we focus on Web track, which contains two tasks, namely ad hoc and diversity. On ad hoc task, we improved the efficiency of our distributed retrieval system TMiner to handle terabytes of Web data. Then three studies have been done, namely page quality estimation, ranking feature analysis, and model comparison. On diversity task, we proposed several new approaches on searching strategy, user intention detection, and duplication elimination. To mine user's intention, we proposed and compared two different strategies, namely 'searching + content-based diversity' which is a kind of result clustering, and 'user based diverse intention prediction + searching' which is in the branch of query expansion.

DTIC

Information Retrieval; Internets

20100018663 Queensland Univ., Australia

Mining Specific and General Features in Both Positive and Negative Relevance Feedback. QUT E-Discovery Lab at the TREC'09 Relevance Feedback Track

Li, Yuefeng; Tao, Xiaohui; Algarni, Abdulmohsen; Wu, Sheng-Tang; Nov 2009; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DP0988007; NSC98-2218-E-468-002

Report No.(s): AD-A517808; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517808

User relevance feedback is usually utilized by Web systems to interpret user information needs and retrieve effective results for users. However, how to discover useful knowledge in user relevance feedback and how to wisely use the discovery knowledge are two critical problems. In TREC 2009, we participated in the Relevance Feedback Track and experimented a model consisting of two innovative stages: one for subject-based query expansion to extract pseudo-relevance feedback; one for relevance feature discovery to find useful patterns and terms in relevance judgements to rank documents. In this paper, the detailed description of our model is given, as well as the related discussions for the experimental results.

DTIC

Feedback; Information Retrieval; Internets; Mining; Negative Feedback; Positive Feedback

20100018664 York Univ., Downsview, Ontario Canada

York University at TREC 2009: Chemical Track

Zhao, Jiashu; Huang, Xiangji; Ye, Zheng; Zhu, Jianhan; Nov 2009; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517809; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517809

Our chemical experiments mainly focus on addressing three major problems in two chemical information retrieval tasks, Technology Survey (TS) task and Prior Art (PA) task. The three problems are: (1) how to deal with chemical terminology synonyms? (2) how to deal with chemical terminology abbreviation? (3) how to deal with long queries in Prior Art (PA) task? In particular, we propose a query expansion algorithm for TS task and a keyword-selection algorithm for PA task. The Mean Average Precision (MAP) for our TS task run york09ca07 using Algorithm 1 was 0.2519 and for our PA task run york09caPA01 using Algorithm 2 was 0.0566. The evaluation results show that both algorithms are effective for improving retrieval performance.

DTIC

Information Retrieval; Surveys

20100018665 California Univ., Santa Cruz, CA USA

UCSC at Relevance Feedback Track

Zhang, Lanbo; Zhang, Yi; de Arma, Jadiel; Yu, Kai; Nov 2009; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517813; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517813

The relevance feedback track in TREC 2009 focuses on two sub tasks: actively selecting good documents for users to

provide relevance feedback and retrieving documents based on user relevance feedback. For the first task, we tried a clustering based method and the Transductive Experimental Design (TED) method proposed by Yu et al.. For clustering based method, we use the K-means algorithm to cluster the top retrieved documents and choose the most representative document of each cluster. The TED method aims to find documents that are hard-to-predict and representative of the unlabeled documents. For the second task, we did query expansion based on a relevance model learned on the relevant documents.
DTIC
Feedback; Information Retrieval

20100018666 Delaware Univ., Newark, DE USA
Minimal Test Collections for Relevance Feedback
Carterette, Ben; Chandar, Praveen; Kailasam, Aparna; Muppaneni, Divya; Thota, Lekha; Nov 2009; 7 pp.; In English
Report No.(s): AD-A517815; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517815

The Information Retrieval Lab at the University of Delaware participated in the Relevance Feedback track at TREC 2009. We used only the Category B subset of the ClueWeb collection; our preprocessing and indexing steps are described in our paper on ad hoc and diversity runs. The second year of the Relevance Feedback track focused on selection of documents for feedback. Our hypothesis is that documents that are good at distinguishing systems in terms of their effectiveness by mean average precision will also be good documents for relevance feedback. Thus we have applied the document selection algorithm MTC (Minimal Test Collections) developed by Carterette et al. that is used in the Million Query Track for selecting documents to be judged to find the right ranking of systems. Our approach can therefore be described as MTC for Relevance Feedback.
DTIC
Collection; Feedback; Greedy Algorithms; Information Retrieval

20100018668 Waterloo Univ., Ontario Canada
Overview of the TREC 2009 Web Track
Clarke, Charles L; Craswell, Nick; Soboroff, Ian; Nov 2009; 10 pp.; In English
Report No.(s): AD-A517817; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517817

The TRECWeb Track explores and evaluates Web retrieval technologies. Currently, the Web Track conducts experiments using the new billion-page ClueWeb09 collection. The TREC 2009 Web Track includes both a traditional ad hoc retrieval task and a new diversity task. The goal of this diversity task is to return a ranked list of pages that together provide complete coverage for a query, while avoiding excessive redundancy in the result list. Topics for the track were created from the logs of a commercial search engine, with the aid of tools developed at Microsoft Research. Given a target query, these tools extracted and analyzed groups of related queries, using co-clicks and other information, to identify clusters of queries that highlight different aspects and interpretations of the target query. These clusters were employed by NIST for topic development. Each resulting topic is structured as a representative set of subtopics, each related to a different user need. Documents were judged with respect to the subtopics, as well as with respect to the topic as a whole. For each subtopic, NIST assessors made a binary judgment as to whether or not the document satisfies the information need associated with the subtopic. These topics were used for both the ad hoc task and the diversity task. A total of 26 groups submitted runs to the track, with many groups participating in both tasks. This report provides an overview of the track, including topic development, evaluation measures, and results.
DTIC
Data Bases; Experiment Design; Information Retrieval

20100018669 York Univ., Downsview, Ontario Canada
York University at TREC 2009: Relevance Feedback Track
Ye, Zheng; Huang, Xiangji; He, Ben; Lin, Hongfei; Nov 2009; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517818; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517818

We describe a series of experiments conducted in our participation in the Relevance Feedback Track. We evaluate two traditional weighting models (BM25 and DFR) for the phase 1 task, which are widely used in text retrieval domain. We also

evaluate a statistics-based feedback model and our proposed feedback model for the phase 2 task. Currently, we are waiting for the overview paper to facilitate further analyses.
DTIC
Feedback; Information Retrieval; Mathematical Models

20100018673 Iowa Univ., Iowa City, IA USA
TREC Blog and TREC Chem: A View from the Corn Fields
Mejova, Yelena; Thuc, Viet Ha; Foster, Steven; Harris, Christopher; Arens, Bob; Srinivasan, Padmini; Nov 2009; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517834; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517834

The University of Iowa Team, participated in the blog track and the chemistry track of TREC-2009. This is our first year participating in the blog track as well as the chemistry track.
DTIC
Corn; Information Retrieval

20100018676 Amsterdam Univ., Netherlands
Result Diversity and Entity Ranking Experiments: Anchors, Links, Text and Wikipedia
Kaptein, Rianne; Koolen, Marijn; Kamps, Jaap; Nov 2009; 11 pp.; In English
Report No.(s): AD-A517853; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517853

In this paper, we document our efforts in participating to the TREC 2009 Entity Ranking and Web Tracks. We had multiple aims: For the Web Track's Adhoc task we experiment with document text and anchor text representation, and the use of the link structure. For the Web Track's Diversity task we experiment with using a top down sliding window that, given the top ranked documents, chooses as the next ranked document the one that has the most unique terms or links. We test our sliding-window method on a standard document text index and an index of propagated anchor texts. We also experiment with extreme query expansions by taking the top n results of the initial ranking as multi-faceted aspects of the topic to construct n relevance models to obtain n sets of results. A final diverse set of results is obtained by merging the n results lists. For the Entity Ranking Track, we also explore the effectiveness of the anchor text representation, look at the co-citation graph, and experiment with using Wikipedia as a pivot. Our main findings can be summarized as follows: Anchor text is very effective for diversity. It gives high early precision and the results cover more relevant sub-topics than the document text index. Our baseline runs have low diversity, which limits the possible impact of the sliding window approach. New link information seems more effective for diversifying text-based search results than the amount of unique terms added by a document. In the entity ranking task, anchor text finds few primary pages , but it does retrieve a large number of relevant pages. Using Wikipedia as a pivot results in large gains of P10 and NDCG when only primary pages are considered. Although the links between the Wikipedia entities and pages in the Clueweb collection are sparse, the precision of the existing links is very high.
DTIC
Anchors (Fasteners); Data Processing; Information Retrieval; Internets; Ranking; Semantics; Texts

20100018677 Know Center, Graz, Austria
Facet Classification of Blogs: Know-Center at the TREC 2009 Blog Distillation Task
Lex, Elisabeth; Granitzer, Michael; Juffinger, Andreas; Nov 2009; 7 pp.; In English
Report No.(s): AD-A517854; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517854

In this paper, we outline our experiments carried out at the TREC 2009 Blog Distillation Task. Our system is based on a plain text index extracted from the XML feeds of the TREC Blogs08 dataset. This index was used to retrieve candidate blogs for the given topics. The resulting blogs were classified using a Support Vector Machine that was trained on a manually labelled subset of the TREC Blogs08 dataset. Our experiments included three runs on different features: firstly on nouns, secondly on stylometric properties, and thirdly on punctuation statistics. The facet identification based on our approach was successful, although a significant number of candidate blogs were not retrieved at all.
DTIC
Classifications; Distillation; Flat Surfaces; Information Retrieval; Internets

20100018678 Mugla Univ., Turkey

IRRA at TREC 2009: Index Term Weighting based on Divergence From Independence Model

Dincer, Bekir T; Kocabase, Ilker; Karaoglan, Bahar; Nov 2009; 16 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517855; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517855

IRRA (IR-Ra) group participated in the 2009 Web track (both adhoc task and diversity task) and the Million Query track. In this year, the major concern is to examine the effectiveness of a novel, nonparametric index term weighting model, divergence from independence (DFI). The notion of independence, which is the notion behind the well-known statistical exploratory data analysis technique called the correspondence analysis (Greenacre, 1984; Jambu, 1991), can be adapted to the index term weighting problem. In this respect, it can be thought of as a qualitative description of the importance of terms for documents, in which they appear, importance in the sense of contribution to the information contents of documents relative to other terms. According to the independence notion, if the ratios of the frequencies of two different terms are the same across documents, they are independent from documents. For example, each Web page contains a pair of html and a pair of body tags, so that the ratio of frequencies of these tags is the same across all Web pages, indicating that the html and body tags are independent from Web pages.

DTIC

Divergence; Indexing (Information Science); Information Retrieval; Internets

20100018679 Dalian Univ. of Technology, China

DUTIR at TREC 2009: Chemical IR Track

Jin, Song; Ye, Zheng; Lin, Hongfei; Nov 2009; 8 pp.; In English

Report No.(s): AD-A517860; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517860

This paper presents the DUTIR submission to TREC 2009 Chemical IR Track. This track included two tasks: Prior Art (PA) and Technical Survey (TS) tasks. We present a series of experiments on two text retrieval models, BM25 and Language Model for IR (LMIR). For Prior Art task, we focused on formulating the queries from the query patents and date filtering. Moreover, some traditional search techniques are used for Technical Survey task.

DTIC

Patents; Texts

20100018796 National Defense Univ., Washington, DC USA

Warfighting in Cyberspace

Alexander, Keith B; Jan 2007; 5 pp.; In English

Report No.(s): AD-A518148; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518148

Our current and potential adversaries clearly understand the military potential of cyberspace and the expansive power of the medium. Terrorists employ the Internet for recruiting, training, motivating, and synchronizing their followers. They can operate essentially unrestrained and are free to innovate, unbound by law, policy, or precedent. Nations such as China and Russia are developing their own ?cyberspace warriors.? China, for instance, has formed cyberspace battalions and regiments, the primary purpose of which is to identify and exploit weaknesses in our military, government, and commercial networks. In November 1999, the PLA Daily stated, Internet warfare is of equal significance to land, sea, and air power and requires its own military branch, and that it is essential to have an all-conquering offensive technology and to develop software and technology for net offensives . . . able to launch attacks and countermeasures. The threat from these forces is credible and real. While the time-tested principles of war will ultimately apply in cyberspace, its characteristics are so radically different that they demand significant innovation and changes to the way we organize and conduct military operations and tactics in this domain. Many within the U.S. Government and private sector are beginning to recognize the importance of cyberspace (and operations within it) to national security. The March 2005 National Defense Strategy identified cyberspace as a new theater of operations and assessed cyberspace operations as a potentially disruptive challenge, concluding that in rare instances, revolutionary technology and associated military innovation can fundamentally alter long-established concepts of warfare.

DTIC

Internets; Warfare

20100018892 Naval Postgraduate School, Monterey, CA USA
Investigation into Text Classification With Kernel Based Schemes
Benveniste, Steven M; Mar 2010; 168 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518358; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development of the Internet has resulted in a rapid explosion of information available on the Web. In addition, the speed and anonymity of internet media publishing make this medium ideal for rapid dissemination of various contents. As a result, there is a strong need for automated text analysis and mining tools, which can identify the main topics of texts, chat room discussions, Web postings, etc. This thesis investigates whether the nonlinear kernel-based feature vector selection approach may be beneficial for categorizing unstructured text documents. Results using a nonlinear kernel-based classification are compared to results obtained using the Latent Semantic Analysis (LSA) Approach commonly used in text categorization applications. The nonlinear kernel-based scheme considered in this work applies the feature vector selection (FVS) approach followed by the Linear Discriminant Analysis (LDA) scheme. Titles, along with abstracts from IEEE journal articles published between 1990 and 1999 with specific key terms, were used to construct the data set for classification. Overall, taking into account both classification performance and timing issues, results showed the FVS-LDA with a polynomial kernel of degree 1, and an added constant of 1, to be the best classifier for the database considered.
DTIC
Classifications; Information Retrieval; Kernel Functions; Texts

20100018901 Naval Postgraduate School, Monterey, CA USA
Perceptions on Social Networking: A Study on Their Operational Relevance for the Navy
Bennington, Jeffrey G; King, Ryan H; Mar 2010; 125 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the beginning of civilization, humans formed social networks under communities bound by common interest. Today the ubiquity of the Internet provides ample opportunity for these groups, once limited by geography, to connect easily and expand beyond city and national borders. The U.S. Navy provides an opportunity to harness the power of electronic social networks to improve enterprise-wide information sharing across strategic, operational, and tactical forums. These networks of trusted connections among people ensure means for watch standers and decision makers to share trusted information with seasoned leaders and subject matter experts. The leverage of electronic social networks in the Navy is significant during manpower reductions that present limiting opportunities for face-to-face collaboration and mentoring, a critical aspect to a war-fighting organization. This thesis presents an evaluation and comparison of the perceptions of social networking of current and future leadership on the value of social networking tools. Moreover, this analysis applies specifically to Navy operations. The relevance of collaboration, trust, professional development, and technological opportunity is examined.
DTIC
Internets; Military Operations; Navy; Perception

20100018927 Naval Research Lab., Washington, DC USA
Comprehensive Maritime Awareness (CMA) Joint Capabilities Technology Demonstration (JCTD)
Dwyer, C T; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518453; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Comprehensive Maritime Awareness (CMA) Joint Capabilities Technology Demonstration (JCTD) is a program to improve Maritime Domain Awareness (MDA). The CMA JCTD vision is to share maritime shipping information throughout the world to deter use of commercial maritime shipping for terrorism, WMD proliferation, drugs, piracy, and human trafficking. CMA serves as an exemplar for a culture of sharing of maritime information between the U.S. and international partners. The project takes advantage of ongoing efforts, proven technologies, and current information-sharing agreements. CMA has two main focus areas: (1) demonstrate the importance of interagency and international information-sharing for improved maritime awareness; and (2) demonstrate improved information management techniques - such as application of the U.S. Department of Defense Net-Centric Data Strategy - to enable effective management of large volumes of shared data. CMA is working cooperatively with the Republic of Singapore. Singapore's position as a nexus for shipping in Southeast Asia provides a unique opportunity for sharing information.
DTIC
Information Systems; Military Operations

20100018972 Naval Postgraduate School, Monterey, CA USA

A Comparative Analysis of Strategic Approaches for Information Technology (IT) Management for Commander Naval Surface Forces

Fisher, James L; Johnson, Devine R; Mar 2010; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518594; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As the lead organization for all USA Naval Surface Forces, Commander Naval Surface Forces (CNSF) is committed to providing operational commanders with well-trained, highly effective, and technologically relevant surface forces. Aligning itself with the Department of the Navy's Information Management (IM) and Information Technology (IT) strategic mission objectives, CNSF is dedicated to delivering secure, interoperable, and integrated IM/IT capabilities to the Marine and Sailor in support of war-fighting missions. CNSF utilizes several IT systems and applications to enhance information collection, sharing, and storage including the Surface Forces (SURFOR) Web, Training and Operational Readiness Informational Services (TORIS), and Continuous Monitoring Program (CMP). In lieu of the Navy's attempt to cut operational budget costs and become more financially responsible, CNSF is discussing options to increase its efficiency in IT contract management. CNSF-one organization with two Type Commander (TYCOM) staffs and support organizations-must institute a strategic approach for the management of IT to maximize efficiency throughout the organization. This thesis will focus on identifying strategic approaches to IT management, from both governmental and nongovernmental perspectives, that will best facilitate the acquisition and management of systems and applications to help achieve the goals and objectives of CNSF.

DTIC

Information Systems; Military Operations

20100018985 Naval Postgraduate School, Monterey, CA USA

WatchKeeper

Martinez, Rodney G; Mar 2010; 80 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518631; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The SAFE Port Act of 2006 designated the Coast Guard as the lead federal agency tasked with building Interagency Operations Centers in critical U.S. ports. A critical component of the IOC initiative is an Information Management System (IMS) to provide improved means for information sharing and coordination among federal, state, local, and public sector stakeholders related to maritime safety and security in critical U.S. ports. The Coast Guard WatchKeeper project is a proposed IMS being designed to address the information sharing and information management challenges faced by these agencies. Unfortunately, the WatchKeeper project has faced many challenges. WatchKeeper was scheduled to deliver initial capability in December 2009, but this delivery date was not met. In addition, the Coast Guard is in the midst of integrating an organization-wide enterprise architecture that requires all information systems to comply with developing standards, practices, and procedures. This thesis provides an analysis of WatchKeeper, including the context surrounding its development, systems architecture, and the potential risks in its development. Three primary practices can be applied to support WatchKeeper development: Enterprise Architecture, Software Architecture, and Software Architecture Evaluation. This thesis reviews literature from leading experts in the field of information technology and software development and makes recommendations accordingly. The author also proposes using Valuable Information at the Right Time (VIRT) methodologies and constructs in further developing WatchKeeper.

DTIC

Architecture (Computers); Coasts; Computer Programming; Management Information Systems; Security; Software Engineering

20100018998 California Univ., Berkeley, CA USA

On the Performance of Quorum Replication on the Internet

Bakr, Omar M; Keidar, Idit; Oct 31, 2008; 14 pp.; In English

Report No.(s): AD-A518655; UCB/EECS-2008-141; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Replicated systems often use quorums in order to increase their performance and availability. In such systems, a client typically accesses a quorum of the servers in order to perform an update. In this paper, we study the running time of quorum-based distributed systems over the Internet. We experiment with more than thirty servers at geographically dispersed locations; we evaluate two different approaches for defining quorums. We study how the number of servers probed by a client impacts performance and availability. We also examine the extent to which cross-correlated message loss affects the ability to predict running times accurately from end-to-end traces.

DTIC

Client Server Systems; Internets; Protocol (Computers)

20100019000 California Univ., Berkeley, CA USA

Angelic Hierarchical Planning: Optimal and Online Algorithms

Marthi, Bhaskara; Russell, Stuart J; Wolfe, Jason; Dec 6, 2008; 22 pp.; In English

Contract(s)/Grant(s): FA8750-05-2-0249; FA8750-07-D-0185

Report No.(s): AD-A518658; UCB/EECS-2008-150; No Copyright; Avail.: Defense Technical Information Center (DTIC)

High-level actions (HLAs) are essential tools for coping with the large search spaces and long decision horizons encountered in real-world decision making. In a recent paper, we proposed an angelic semantics for HLAs that supports proofs that a high-level plan will (or will not) achieve a goal, without first reducing the plan to primitive action sequences. This paper extends the angelic semantics with cost information to support proofs that a high-level plan is (or is not) optimal. We describe the Angelic Hierarchical A* algorithm, which generates provably optimal plans, and show its advantages over alternative algorithms. We also present the Angelic Hierarchical Learning Real-Time A* algorithm for situated agents, one of the first algorithms to do hierarchical lookahead in an online setting. Since high-level plans are much shorter, this algorithm can look much farther ahead than previous algorithms (and thus choose much better actions) for a given amount of computational effort. This is an extended version of a paper by the same name appearing in ICAPS '08.

DTIC

Algorithms; Hierarchies; Information Retrieval; Machine Learning; On-Line Systems; Semantics

20100019001 California Univ., Berkeley, CA USA

Learning Data Driven Representations from Large Collections of Multidimensional Patterns with Minimal Supervision

Ahammad, Parvez; Aug 4, 2008; 150 pp.; In English

Contract(s)/Grant(s): DAAD19-02-1-0383; W911NF-06-1-0076

Report No.(s): AD-A518662; UCB/EECS-2008-90; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Traditionally, taking experimental measurements of a physical or biological phenomenon was an expensive, laborious and very slow process. However, significant advances in device technologies and computational techniques have sharply reduced the costs of data collection. Capturing thousands of images of developing biological organisms, or recording enormous amounts of video footage from a network of cameras monitoring an observation space, or obtaining a large number of neural measurements of brain signal patterns via non-invasive devices are some of the examples of such data proliferation. Analyzing such large volumes of multi-dimensional data through expert supervision is neither scalable nor cost-effective. In this context, there is a need for systems that complement the expert user by learning meaningful and compact representations from large collections of multidimensional data (images, videos etc.) with minimal supervision. In this dissertation, we present minimally supervised solutions to two such scenarios generally encountered.

DTIC

Algorithms; Alignment; Data Bases; Data Processing; Machine Learning; Pattern Recognition; Personnel Management

20100019011 Naval Postgraduate School, Monterey, CA USA

MYSEA: The Monterey Security Architecture

Irvine, Cynthia E; Nguyen, Thuy D; Shifflett, David J; Levin, Timothy E; Khosalim, Jean; Prince, Charles; Clark, Paul C; Gondree, Mark; Jan 2009; 11 pp.; In English

Report No.(s): AD-A518680; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mandated requirements to share information across different sensitivity domains necessitate the design of distributed architectures to enforce information flow policies while providing protection from malicious code and attacks devised by highly motivated adversaries. The MYSEA architecture uses component security services and mechanisms to extend and inter-operate with commodity PCs, commodity client software, applications, trusted components, and legacy single level networks, providing new capabilities for composing secure, distributed multilevel secure solutions. This results in an architecture that meets two compelling requirements: first, that users have a familiar work environment, and, second, that critical mandatory security policies are enforced.

DTIC

Access Control; Intrusion; Numerical Control; Policies; Safety Devices; Security

20100019023 Naval Postgraduate School, Monterey, CA USA

Baseline Assessment of Information Technology Contracts Funded by Commander, Naval Surface Forces

Roberts, David E; Peltonen, Jeffry M; Ozeck, David J; Mar 2010; 114 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518713; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project developed a baseline assessment for assisting Commander, Naval Surface Forces (CNSF) leaders and

managers in understanding and improving the following information technology programs: Training and Operational Readiness Information Services (TORIS), Continuous Monitoring Program (CMP), and the CNSF Web. The programs were described, assessed, and evaluated in terms of their backgrounds, mission needs, performance, technical requirements, functionality, and contractual terms. One conclusion was that the contractual statement of work does not measure the performance of the system; rather, it is designed to mandate the requirements for the contractor's performance (e.g., indicators that measure downtime, trouble calls, and software bugs are missing). An overarching recommendation is to integrate all staff information technology functions under one authority, while establishing simple and relevant program performance benchmarks to measure and track actual performance.
DTIC
Information Systems; Technology Assessment

20100019192 Vision Systems and Technology, Inc., Ellicott City, MD USA
Secure Wireless Knowledge Management for Intelligence Analysis
Clark, Catherine H; Spina, John; Corey, Michael; Proceedings of the SPIE Defense and Security Symposium; Ap.r 2008; 10 pp.; In English; SPIE Defense and Security Symposium, April 2008, Orlando, Fl, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-C-0107; Proj-08SB
Report No.(s): AD-A518607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although more information than ever before is available to support the intelligence analyst, the vast proliferation of types of data, devices, and protocols makes it increasingly difficult to ensure that the right information is received by the right people at the right time. Analysts struggle to balance information overload and an information vacuum depending on their location and available equipment. The ability to securely manage and deliver critical knowledge and actionable intelligence to the analyst regardless of device configuration, classification level or location in a reliable manner would provide the analyst 24/7 access to useable information. There are several important components to an intuitive system that can provide timely information in a user-preferred manner. Two of these components: information presentation based on the user's preference and requirements and the identification of solutions to the problem of secure information delivery across multiple security levels will be discussed in this paper.
DTIC
Computers; Information Transfer; Intelligence; Management Analysis; Security

20100019213 California Univ., Berkeley, CA USA
Answering Questions about Complex Events
Sinha, Steve K; Dec. 19, 2008; 208 pp.; In English
Report No.(s): AD-A518661; UCB/EECS-2008-175; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reasoning about event structure is a fundamental research problem in Artificial Intelligence. Event scenarios and procedures are inherently about change of state. To understand them and answer questions about them requires a means of describing, simulating and analyzing the underlying processes, taking into account preconditions and effects, the resources they produce and consume, and their interactions with each other. We propose a novel, comprehensive event schema that covers many of the parameters required and has explicit links to language through FrameNet. Based on the event schema, we have implemented a dynamic model of events capable of simulation and causal inference. We describe the results of applying this event reasoning platform to question answering and system diagnosis, providing responses to questions on justification, temporal projection, ability and 'what-if' hypotheticals, as well as complex problems in diagnosis of systems with incomplete knowledge.
DTIC
Computer Programs; Dynamic Models; Semantics

20100019245 Marine Corps War Coll., Quantico, VA, USA
Knowledge Gap and Transfer Issues in Financial Management
Pham, Duy T.; February 20, 2009; 12 pp.; In English
Report No.(s): AD-A517811; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517811

A mission lacks of financial resource is a mission impossible. Marine Corps financial managers have the responsibility to manage their commanders' financial resource effectively to accomplish the mission. However, the constant personnel

turnover and the lack of a knowledge management system in the Marine Corps financial management process are causing a knowledge gap and limiting knowledge transfer thereby negatively affecting the financial managers' ability to carryout their duty. Fortunately, the recent advent of information technology has made it possible for many organizations to retain and share valuable information among individual employees to improve performance and efficiency. The concept of retaining and sharing knowledge among members within an organization is known as knowledge management (KM). With that being said, the Marine Corps should implement a KM system in the financial management process to correct the knowledge gap and facilitate knowledge transfer that is crucial to the financial managers' overall effectiveness.
DTIC
Financial Management; Information Management

20100019253 National Oceanic and Atmospheric Administration, Silver Spring, MD USA
Partners in Data Management: Creating a National Channel Framework Database by the National Oceanic and Atmospheric Administration and the US Army Corps of Engineers
Libeau, Christopher M.; Published in the Proceedings of the MTS/IEEE Oceans 2007: Edge of Tomorrow; January 2007; 5 pp.; In English; MTS/IEEE Oceans Conference 2007: Edge of Tomorrow, 29 Sep. - 4 Oct. 2007, Vancouver, Canada, Canada; Original contains color illustrations
Report No.(s): AD-A518623; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The USA Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA) work closely together to provide navigation information to the maritime community. NOAA is responsible for charting the territorial waters of the USA including navigation channels used by transiting vessels into and out of USA ports. These navigation channels are portrayed and described on NOAA products including the NOAA Electronic Navigation Chart (NOAA ENC). The NOAA ENC is a vector- based digital file containing marine features suitable for marine navigation. The USACE is responsible to maintain the navigation channels and to provide accurate channel data to NOAA. The USACE channel data consist of hydrographic survey information and channel framework. Channel framework contains the outside channel limits and the inside configuration of the navigation channel. USACE channel data supplies essential information to the mariner and, therefore, comprise a fundamental component of the NOAA ENC . NOAA and USACE are working closely to communicate issues concerning USACE hydrographic survey work and channel framework data. This continuing effort provides improved navigation products for the mariner.
DTIC
Data Bases; Engineers; Hydrography; Marine Transportation; Surface Navigation; Surveys

20100019299 Cairo Microsoft Innovation Center (CMIC), Abou Rawash, Egypt
CMIC\@TREC-2009: Relevance Feedback Track
Darwish, Kareem; El-Deeb, Ahmed; Nov 2009; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517870; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517870
This paper describes CMIC's submissions to the TREC'09 relevance feedback track. In the phase 1 runs we submitted, we experimented with two different techniques to produce 5 documents to be judged by the user in the initial feedback step, namely using knowledge bases and clustering. Both techniques attempt to topically diversify these 5 documents as much as possible in an effort to maximize the probability that they contain at least 1 relevant document. The basic premise is that if a query has n diverse interpretations, then diversifying results and picking the top 5 most likely interpretations would maximize the probability that a user would be interested in at least one interpretation. In phase 2 runs, which involved the use of the feedback attained from phase 1 judgments, we attempted to use positive and negative judgments in weighing the terms to be used for subsequent feedback.
DTIC
Feedback; Judgments; Probability Theory

20100019346 SRA International, Inc., Dayton, OH USA
Strategy Planning Visualization Tool (SPVT) for the Air Operations Center (AOC), Volume 1, SPVT Summary and COA Sketch
Calhoun, Christopher; Monk, Donald; Dec. 2009; 357 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-C-6537; Proj-2830
Report No.(s): AD-A518311; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The purpose of this program is to transition innovative work support within the AOC. The idea is to allow decisions to

be made and plans to be formulated more quickly by providing users with intuitive, high-level visualizations of mission effects, interrelationships and mechanisms. The end result will be improved planning and assessment within the air tasking order (ATO) cycle.
DTIC
Decision Support Systems; Management Planning

20100019349 Executive Office of the President, Washington, DC USA
Report to the President and Congress on the Third Assessment of The National Nanotechnology Initiative
Mar. 12, 2010; 93 pp.; In English
Report No.(s): AD-A518301; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Nanotechnology Initiative (NNI) is the U.S. Government's cross-cutting program that coordinates Federal research and development (R&D) activities in nanoscale science, engineering, technology, and related efforts among various participating agencies. The Federal Government launched the NNI in FY 2001 with an initial $500 million budget to accelerate the development of nanotechnology. Over the ensuing 10 years, with cumulative Federal spending of $12 billion, the NNI has played a key role in positioning the USA as the world leader in both nanotechnology R&D and commercialization. The NNI has also catalyzed State activities that leverage Federal investments with a focus on economic growth and job creation. Indeed, nanotechnology appears slated to become an important contributor to the economic growth of the USA over the coming decade and beyond. Today, the NNI is a multi-agency initiative that now includes 25 Federal agencies, 15 of which in FY 2011 will have their own individual budgets for nanotechnology R&D. The NNI is managed within the framework of the National Science and Technology Council (NSTC), the Cabinet-level council by which the President coordinates science and technology policy across the Federal Government. The Nanoscale Science, Engineering, and Technology (NSET) Subcommittee of the NSTC coordinates the planning, budgeting, program implementation, and review of the NNI. The National Nanotechnology Coordination Office (NNCO) provides technical and administrative support to the NSET Subcommittee, serves as a central point of contact for Federal nanotechnology R&D activities, and engages in public outreach on behalf of the NNI. The NNCO also serves as a liaison to academia, industry, professional societies, foreign organizations, and others to exchange technical and programmatic information.
DTIC
Nanotechnology; Presidential Reports

20100019356 National Oceanic and Atmospheric Administration, Silver Spring, MD USA
International Polar Year 2007 - 2008 Resources on Polar Research in the NOAA Central Library Network
Fiolek, A; Proceedings of the MTS/IEEE Oceans 2007 Conference; Jan. 2007; 5 pp.; In English; MTS/IEEE Oceans 2007 Conference, 29 Sep. - 4 Oct. 2007, Vancoulver, BC, Canada; Original contains color illustrations
Report No.(s): AD-A518442; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Located in Silver Spring, Maryland, the NOAA Central Library (NCL) networks over thirty NOAA libraries nationwide. NCL is considered the historically richest and most comprehensive multi-disciplinary scientific collection in hydrographic surveying, oceanography, ocean engineering, atmospheric sciences (climatology and meteorology), meteorological satellite applications, living marine resources, geophysics, cartography, and mathematics in the USA, possibly in the Western Hemisphere. It incorporates holdings of NOAA's predecessor agencies, including the Coast and Geodetic Survey, the Weather Bureau, and the Bureau of Fisheries. The collections reflect the history of these organizations, their scientific research, observations and data from 1820 to the present. The NOAA Library Network collections are unique: over 40% of the items in NOAALINC (the online catalog) and their manual catalogs are not found anywhere else. Unique polar research materials include historic and current reports from various polar expeditions, with research and observations from both the Arctic and Antarctic regions. The presence of these unique and historical resources in NOAA prompted the Library to participate in 4th International Polar Year (IPY) 2007-2008 activities. Many unique and historically valuable NOAA polar research documents and scientific data, in the forms of digital videos, still images, and datasets, have been entered into the NOAALINC, the National Oceanographic Data Center (NODC) Ocean Archive System (OAC), and other oceanographic information catalogs and databases. This was possible thanks to the Library's collaboration with several NOAA projects and programs, including the Video Data Management System (VDMS), Climate Data Modernization Program (CDMP), and NODC Cruise Report Program.
DTIC
Libraries

20100019376 Illinois Univ. at Urbana-Champaign, Urbana, IL USA

Finding Related Entities by Retrieving Relations: UIUC at TREC 2009 Entity Track

Vinod Vydiswaran, V G; Ganesan, Kavita; Lv, Yuanhua; He, Jing; Zhai, ChengXiang; Nov 2009; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517759; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517759

Our goal in participating in the TREC 2009 Entity Track was to study whether relation extraction techniques can help in improving accuracy of the entity finding task. Finding related entities is informational in nature and we wanted to explore if inducing structure on the queries helps satisfy this information need. The research outlook we took was to study techniques that retrieve relations between two entities from a large corpus, and from those, find the most relevant entities that participate in the given relation with another given entity. Instead of aiming at retrieving pages about specific entities, we tried to address the problem of directly finding the entities from the text. Our experimental results show that we were able to find many related entities using relation-based extraction, and ranking entities based on further evidence from the text helps to a certain extent.

DTIC

Information Retrieval; Texts; Ranking

20100019380 Lawrence Livermore National Lab., Livermore, CA USA

Reconcile: A Coreference Resolution Research Platform

Soyanov, V.; Cardie, C.; Gilber, N.; Riloff, E.; Buttler, D.; November 25, 2009; 16 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-48

Report No.(s): DE2010-970156; LLNL-TR-420722; No Copyright; Avail.: Department of Energy Information Bridge

Despite the availability of standard data sets and metrics, approaches to the problem of noun phrase coreference resolution are hard to compare empirically due to the different evaluation setting stemming, in part, from the lack of comprehensive coreference resolution research platforms. In this tech report we present Reconcile, a coreference resolution research platform that aims to facilitate the implementation of new approaches to coreference resolution as well as the comparison of existing approaches. We discuss Reconcile's architecture and give results of running Reconcile on six data sets using four evaluation metrics, showing that Reconcile's performance is comparable to state-of-the-art systems in coreference resolution.

NTIS

Coherence; Computer Programs; Architecture (Computers)

20100019406 Delaware Univ., Newark, DE USA

Axiomatic Approaches to Information Retrieval - University of Delaware at TREC 2009 Million Query and Web Tracks

Zheng, Wei; Fang, Hui; Nov 2009; 7 pp.; In English

Report No.(s): AD-A517756; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517756

We report our experiments in TREC 2009 Million Query track and Adhoc task of Web track. Our goal is to evaluate the effectiveness of axiomatic retrieval models on the large data collection. Axiomatic approaches to information retrieval have been recently proposed and studied. The basic idea is to search for retrieval functions that can satisfy all the reasonable retrieval constraints. Previous studies showed that the derived basic axiomatic retrieval functions are less sensitive to the parameters than the other state of the art retrieval functions with comparable optimal performance. In this paper, we focus on evaluating the effectiveness of the basic axiomatic retrieval functions as well as the semantic term matching based query expansion strategy. Experiment results of the two tracks demonstrate the effectiveness of the axiomatic retrieval models.

DTIC

Information Retrieval; Data Acquisition

20100019407 Universiteit Twente, Enschede, Netherlands

University of Twente \@ TREC 2009: Indexing Half a Billion Web Pages

Hauff, Claudia; Hiemstra, Djoerd; Nov 2009; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517748

The University of Twente participated in three tasks of TREC 2009: the adhoc task, the diversity task and the relevance feedback task. All experiments are performed on the English part of ClueWeb09. We describe our approach to tuning our

retrieval system in absence of training data in Section 3. We describe the use of categories and a query log for diversifying search results in Section 4. Section 5 describes preliminary results for the relevance feedback task.infro
DTIC
Information Retrieval; Education; Tuning

20100019408 Lehigh Univ., Bethlehem, PA USA
Diversifying Search Results with Popular Subtopics
Yin, Dawei; Xue, Zhenzhen; Qi, Xiaoguang; Davison, Brian D; Oct 25, 2009; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): IIS-0545875
Report No.(s): AD-A517746; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517746

The problem we aim to solve is the diversification of search results for ambiguous web queries. We present a model based on knowledge of the diversity of query subtopics to generate a diversified ranking for retrieved documents. We expand the original query into several related queries, assuming that query expansions expose subtopics of the original query. Moreover, each query expansion is given a weight which reflects the likelihood of the interpretation (the fraction of users who issued this query given the general query topic). We issue all those expanded queries including the original query to a standard BM25 search engine, then re-rank the retrieved documents to generate the final ranking. Our method can detect possible subtopics of a given query and provide a reasonable ranking that satisfies both relevancy and diversity metrics. The TREC evaluations show our method is effective on the diversity task.
DTIC
Information Retrieval; Query Languages

20100019411 Beijing Univ. of Posts and Telecommunications, Beijing, China
BUPT at TREC 2009: Entity Track
Wang, Zhanyi; Liu, Dongxin; Xu, Weiran; Chen, Guang; Guo, Jun; Nov 2009; 7 pp.; In English
Report No.(s): AD-A517704; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517704

This report introduces the work of BUPT (PRIS) in Entity Track in TREC2009. The task and data are both new this year. In our work, an improved two-stage retrieval model is proposed according to the task. The first stage is document retrieval, in order to get the similarity of the query and documents. The second stage is to find the relationship between documents and entities. We also focus on entity extraction in the second stage and the final ranking.
DTIC
Information Retrieval; Analogies; Ranking

20100019420 California Univ., Berkeley, CA USA
Engineering Structurally Configurable Models with Model Transformation
Feng, Thomas H; Dec 15, 2008; 36 pp.; In English
Contract(s)/Grant(s): W911NF-07-2-0019; FA9550-06-0312
Report No.(s): AD-A518660; UCB/EECS-2008-159; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Complex configurable models of embedded software systems are hard to design and maintain, especially when model structures are variable and the number of allowable configurations is unlimited. We employ model transformation as an underlying technique to configure model structures. A transformation tool is created for actor models that automates tasks in the development workflow. Such tasks include structural configuration with user-specified parameters, resetting enhanced models to simple forms for modification and update, and validating consistency in model structures. As an example, we provide a structurally configurable actor-oriented model of a distributed system using the MapReduce pattern to justify our approach.
DTIC
Computer Programs; Software Engineering; Consistency

20100019424 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Analysis of the Elements of Collaboration Associated with Top Collaborative Tools

Nagy, Kristopher C; Mar. 2010; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518720; AFIT/GIR/ENV/10-M01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

USA government agencies have historically had problems with inter- agency information sharing and collaboration. In fact, the National Commission on Terrorist Attacks upon the United Stated recommended that the U.S. government increase information sharing and improve collaboration across government agencies. To this day, no collaborative tools are being used to satisfy that recommendation. In fact, there is little agreement on what collaboration means and what characteristics are best suited for collaborative tools. Before we can improve collaboration across agencies, we need to better understand the nature of collaboration itself, and the hallmarks of better collaborative tools. As such, this research developed an academically inspired definition of collaboration. With the definition in hand, the foundational elements of collaboration were documented in a collaborative framework. The framework was then used to assess collaborative tools and identify the key elements of better collaborative tools. Six of the nine academic elements of collaboration were strongly supported in the assessments. The greatest advantage of this framework is that it provides a methodic and logical process for selecting collaborative tools based on the academic elements of collaboration.

DTIC

Interoperability; Information Transfer

20100019465 Army War Coll., Carlisle Barracks, PA USA

War is War? The Utility of Cyberspace Operations in the Contemporary Operational Environment. Workshop Initial Impressions

Murphy, Dennis; February 2010; 5 pp.; In English

Report No.(s): AD-A518178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518178

The USA Army War College in partnership with The SecDev Group conducted a workshop examining cyberspace operations from the warfighter's perspective. The workshop was held 26-28 January 2010 at the Collins Center for Strategic Leadership, U.S. Army War College, Carlisle Barracks, Pennsylvania. The U.S. Department of Defense (DoD) defines cyberspace operations as the employment of cyber capabilities where the primary purpose is to achieve military objectives or effects in or through cyberspace. Cyberspace emerged as a national-level concern through several recent events of geo-strategic significance. Estonian infrastructure was attacked in the spring of 2007, allegedly by Russian hackers. In August 2008, Russia again allegedly conducted cyber attacks, this time in a coordinated and synchronized kinetic and non-kinetic campaign against Georgia. It is plausible that such complex excursions may become the norm in future warfare among nation-states having the capabilities to conduct them. Much has been written about the issues of cyberspace at the national strategic level: lack of attribution and the applicability of the law of armed conflict and of international treaties, and the determination of criminality vice acts of war. But the current body of knowledge does not inform us about how the concept of cyberspace operations impacts and will be adapted by warfighting commanders in the contemporary and future operational environments. The workshop examined this issue and used the Russia-Georgia case study to draw lessons to apply to current and future warfare. The workshop centered on three challenges. The first challenge considered conducting a campaign where cyberspace is contested/constrained and the impact on U.S. warfighting concepts and practices.

DTIC

Cybernetics; Russian Federation; Warfare

20100019638 Omega Navigation System Center, Alexandria, VA USA

U.S. Coast Guard GPS Information Center (GPSIC) and Its Function Within the Civil GPS Service (CGS)

Nov 3, 1992; 17 pp.; In English

Report No.(s): AD-A518831; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518831

In 1987, the U.S. Department of Defense (DOD) formally requested that the U.S. Department of Transportation (DOT) take responsibility for providing an office that would respond to nonmilitary user needs for GPS information, data, and assistance. DOT accepted this responsibility and in February 1989, named the Coast Guard as their lead agency for the project. Since that time, the U.S. Coast Guard has worked with the U.S. Space Command to develop requirements and implement a plan for providing the requested interface with the civil GPS community. The Civil GPS Service (CGS) consists of four main elements: GPS Information Center (GPSIC) -provides GPS status informationh users of the system; Civil GPS Service

Interface Commiitee (CGSIC) - established to identify civil GPS user technical information needs in support of the CGS program; Differential GPS (DGPS) - Coast Guard Research and Development Project; PPS Program Office (PPSPO) - (Under development) will administer the program allowing qualified civil users to have access to the PPS signal. This paper will provide details about the services these organizations provide.
DTIC
Coasts; Global Positioning System

20100019642 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Developing Cyberspace Data Understanding: Using CRISP-DM for Host-based IDS Feature Mining
Erskine, Joseph R; Mar 2010; 136 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518837; AFIT/GCS/ENG/10-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518837

Current intrusion detection systems generate a large number of specific alerts, but do not provide actionable information. Many times, these alerts must be analyzed by a network defender, a time consuming and tedious task which can occur hours or days after an attack occurs. Improved understanding of the cyberspace domain can lead to great advancements in Cyberspace situational awareness research and development. This thesis applies the Cross Industry Standard Process for Data Mining (CRISP-DM) to develop an understanding about a host system under attack. Data is generated by launching scans and exploits at a machine outfitted with a set of host-based data collectors. Through knowledge discovery, features are identified within the data collected which can be used to enhance host-based intrusion detection. By discovering relationships between the data collected and the events, human understanding of the activity is shown. This method of searching for hidden relationships between sensors greatly enhances understanding of new attacks and vulnerabilities, bolstering our ability to defend the cyberspace domain.
DTIC
Information Retrieval; Intrusion; Mining; Situational Awareness

20100019684 ITT Corp., Rome, NY USA
Defense Technical Information Center Managed Services for DoD Generated Datasets
Choo, Victor; McGibbon, Thomas; Villalba, Carlos; Mar 3, 2010; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): SPO700-98-D-4000; Proj-DACS
Report No.(s): AD-A518971; ITT/DACS/DO61/TR2010/01; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518971

The objective of this effort is to examine the DoD Research, Development, Test & Evaluation (RDT&E) community's interest in establishing a capability that allows DoD users to discover and acquire datasets that are created as part of DoD RDT&E programs. In this context, the term dataset means a collection of related information and may include items such as sensor data (e.g., radar data), video data, still images, or monitored information (e.g., computer network traffic) to name a few. The data may be stored in a series of files or a database of records. DTIC has been chartered with the dissemination of technical reports generated by the DoD RDT&E community for a number of years. The inclusion of datasets, some of which are collected to generate the technical reports, is a natural enhancement of DTIC's services.
DTIC
Computer Storage Devices; Defense Program; Information Retrieval; Information Systems

20100019745 Army Research Lab., Fort Hood, TX USA
An Annotated Bibliography of MANPRINT-Related Assessments and Evaluations Conducted by the U.S. Army, 2nd Edition: 1953 to 2009. Volume 1- Index
Middlebrooks, Sam E; Feb 2010; 309 pp.; In English
Report No.(s): AD-A519115; ARL-SR-188; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519115

The term manpower and personnel integration (MANPRINT) was coined in 1984 by General Richard H. Thompson, Commanding General of the U.S. Army Materiel Command. MANPRINT became an official directorate in the Office of the Deputy Chief of Staff for Personnel in 1987. In 1991, MANPRINT was expanded to include Automated Information Systems (AIS). This report is the second edition of this document and references 583 MANPRINT assessments and evaluations performed by the MANPRINT community as required by U.S. Army Regulation 602-2 that were conducted by the U.S. Army

between 1953 and the date of this report in 2009. New to this edition are 443 reports regulated by Army Regulation 73-1 and produced by the Army test and evaluation (T&E) community from 1979 that address MANPRINT issues. Covering both of these categories are 1026 assessment reports related to MANPRINT reported in this bibliography that are covered under AR 73-1 and AR 602-2. While the MANPRINT program was officially established in the late 1980s, there had been work in what was to become many of the MANPRINT domains going back many years. Searches of the available archives in various Army organizational databases and files produced study reports from 1953 onward for work for, and related to, the official MANPRINT program and from 1979 onward for T&E related work. Readers and users of this bibliography are encouraged to contact the author if additional studies and reports are discovered, or are known to exist, so that they can be included in future editions of this work.
DTIC
Annotations; Bibliographies

20100019752 Army Research Lab., Fort Hood, TX USA
An Annotated Bibliography of MANPRINT-Related Assessments and Evaluations Conducted by the U.S. Army, 2nd Edition: 1953 to 2009. Volume 3 - Test and Evaluation Reports
Middlebrooks, Sam E; Feb 2010; 420 pp.; In English
Report No.(s): AD-A519130; ARL-SR-190; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519130

The term manpower and personnel integration (MANPRINT) was coined in 1984 by General Richard H. Thompson, Commanding General of the U.S. Army Materiel Command. MANPRINT became an official directorate in the Office of the Deputy Chief of Staff for Personnel in 1987. In 1991, MANPRINT was expanded to include Automated Information Systems (AIS). This report is the second edition of this document and references 583 MANPRINT assessments and evaluations performed by the MANPRINT community as required by U.S. Army Regulation 602-2 that were conducted by the U.S. Army between 1953 and the date of this report in 2009. New to this edition are 443 reports regulated by Army Regulation 73-1 and produced by the Army test and evaluation (T&E) community from 1979 that address MANPRINT issues. Covering both of these categories are 1026 assessment reports related to MANPRINT reported in this bibliography that are covered under AR 73-1 and AR 602-2. While the MANPRINT program was officially established in the late 1980s, there had been work in what was to become many of the MANPRINT domains going back many years. Searches of the available archives in various Army organizational databases and files produced study reports from 1953 onward for work for, and related to, the official MANPRINT program and from 1979 onward for T&E related work. Readers and users of this bibliography are encouraged to contact the author if additional studies and reports are discovered, or are known to exist, so that they can be included in future editions of this work.
DTIC
Annotations; Bibliographies; Evaluation; System Effectiveness

20100019794 Ohio State Univ., Columbus, OH USA
Integrated Fusion, Performance Prediction, and Sensor Management for Automatic Target Exploitation
Moses, Randolph L; Castanon, David; Cetin, Mujdat; Ertin, Emre; Fisher, III, John W; Hero, III, Alfred O; Karl, Clem; Potter, Lee C; Srivastava, Anuj; Willsky, Alan; May 30, 2007; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-0324
Report No.(s): AD-A519272; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519272

This report summarizes the research activities of this MURI project during the first year. Significant research advances have been made in the areas of innovative sensor signal processing, information fusion, and sensor management, and several cross-disciplinary problems in these three areas have been addressed. The MURI team has been active in research dissemination via publication and attendance at conferences and workshops, and has engaged in technology transformation via student internships and participation in government workshops and research direction discussions.
DTIC
Exploitation; Information Retrieval; Multisensor Fusion; Performance Prediction; Signal Processing; Targets

20100019876 Fraunhofer Inst., Sankt Augustin, Germany

Patent Retrieval in Chemistry based on Semantically Tagged Named Entities

Gurulingappa, Harsha; Mueller, Bernd; Klinger, Roman; Mevissen, Heinz-Theodor; Hofmann-Apitius, Martin; Fluck, Juliane; Friedrich, Christoph M; Nov 2009; 10 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519347; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper reports on the work that has been conducted by Fraunhofer SCAI for Trec Chemistry (Trec-Chem) track 2009. The team of Fraunhofer SCAI participated in two tasks, namely Technology Survey and Prior Art Search. The core of the framework is an index of 1.2 million chemical patents provided as a data set by Trec. For the technology survey, three runs were submitted based on semantic dictionaries and noun phrases. For the prior art search task, several fields were introduced into the index that contained normalized noun phrases, biomedical as well as chemical entities. Altogether, 36 runs were submitted for this task that were based on automatic querying with tokens, noun phrases and entities along with different search strategies.

DTIC

Biomedical Data; Medical Science; Patents

20100019916 Columbia Univ., New York, NY USA

Masquerade Detection Using a Taxonomy-Based Multinomial Modeling Approach in UNIX Systems

Salem, Malek B; Stolfo, Salvatore J; Aug 25, 2008; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-1-0151; 60NANB1D0127

Report No.(s): AD-A519454; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents one-class Hellinger distance-based and one-class SVM modeling techniques that use a set of features to reveal user intent. The specific objective is to model user command profiles and detect deviations indicating a masquerade attack. The approach aims to model user intent, rather than only modeling sequences of user issued commands. We hypothesize that each individual user will search in a targeted and limited fashion in order to find information germane to their current task. Masqueraders, on the other hand, will likely not know the file system and layout of another user's desktop, and would likely search more extensively and broadly. Hence, modeling a user search behavior to detect deviations may more accurately detect masqueraders. To that end, we extend prior research that uses UNIX command sequences issued by users as the audit source by relying upon an abstraction of commands. We devised a taxonomy of UNIX commands that is used to abstract command sequences. The experimental results show that the approach does not lose information and performs comparably to or slightly better than the modeling approach based on simple UNIX command frequencies.

DTIC

Computer Information Security; Computer Programming; Mathematical Models; Security; Taxonomy; Unix (Operating System)

20100019982 Naval Personnel Command, Millington, TN USA

Information Systems Technician (IT) Distribution

Walker, John; Mar 12, 2010; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

NNFE - Naval NETWAR FORCEnet Enterprise: Enterprise-Wide Approach to the Business of C5I and Information Operations. MISSION: Lead the execution of FORCEnet and optimize the employment of Information Operations (Io), Signals Intelligence (SIGINT), and Space capabilities. Develop, deliver and sustain end-to-end Doctrine, Organization, Training, Material, Leadership, Personnel and Facilities (DOTMLPF) capabilities for secure, interoperable, and integrated sensors, weapons and networks to Naval Forces across the range of warfighting. VISION: A Warfighting Enterprise that effectively delivers warfighting and business information capabilities and systems, Tactics, Techniques and Procedures (TTP), and people to Naval, Joint and Coalition Forces to win in all phases of warfare.

DTIC

Combat; Information Systems; Intelligence

20100020138 National Oceanic and Atmospheric Administration, Washington, DC, USA

COASTIRS: Coastal Information Retrieval System, 1980

January 1980; 78 pp.; In English

Report No.(s): PB2010-108496; No Copyright; Avail.: CASI: A05, Hardcopy

The COASTIRS project involved the development of an information retrieval system for the Coastal Zone, which would

aid planners in minimizing the adverse impact of potential offshore oil development.
NTIS
Coasts; Information Retrieval; Marine Environments; Coastal Ecology; Environment Effects; Oil Exploration; Hazards

20100020140 Chemonics International, Inc., Washington, DC, USA
Inventory of Land Use Management Practices: A Discussion Paper
Fiebig, William; January 17, 1995; 8 pp.; In English
Contract(s)/Grant(s): DHR-5438-C-00-1091-00
Report No.(s): PB2010-107616; No Copyright; Avail.: CASI: A02, Hardcopy

This is an illustrative example of how I structured the inventory of NRM practices. I have started with the practices (and the variable codes) from the KAP surveys, which the Agriculture and Natural Resources Office (ANRO) of USAID Senegal is monitoring in the five regions. This will make it possible to integrate the information on those practices (disaggregated by gender) that are gleaned from our analysis of the KAP data in the NRM database structured according to the NRM analytical framework.
NTIS
Earth Resources; Inventory Management; Land Use; Resources Management; Senegal

20100020271 Lawrence Livermore National Lab., Livermore, CA USA
Enhancing Seismic Calibration Research Through Software Automation and Scientific Information Management
Ruppert, Stanley D.; Dodge, Douglas A.; Ganzberger, Michael D.; Hauk, Teresa F.; Matzel, Eric M.; Proceedings of the 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; September 2007, pp. 965-974; In English; 29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 25-27 Sep. 2007, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): AD-A519671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The National Nuclear Security Administration (NNSA) Ground-Based Nuclear Explosion Monitoring Research and Engineering (GNEMRE) Program at Lawrence Livermore National Laboratory (LLNL) has made significant progress enhancing the process of deriving seismic calibrations and performing scientific integration, analysis, and information management with software automation tools. Several achievements in schema design, data visualization, synthesis, and analysis were completed this year. Our tool efforts address the problematic issues of very large datasets and varied formats encountered during seismic calibration research. As data volumes have increased, scientific information management issues such as data quality assessment, ontology mapping, and metadata collection that are essential for production and validation of derived calibrations have negatively impacted researchers? abilities to produce products. New information management and analysis tools have resulted in demonstrated gains in efficiency of producing scientific data products and improved accuracy of derived seismic calibrations. Significant software engineering and development efforts have produced an object-oriented framework that provides database centric coordination between scientific tools, users, and data. Nearly a half billion parameters, signals, measurements, and metadata entries are all stored in a relational database accessed by an extensive object-oriented multi-technology software framework that includes elements of stored procedures, real-time transactional database triggers and constraints, as well as coupled Java and C++ software libraries to handle the information interchange and validation requirements.
DTIC
Calibrating; Computer Programming; Computer Programs; Information Management; Software Engineering

20100020292 Office of the Secretary of Defense, Washington, DC USA
Multiple Independent Levels of Security: The Changing Face of Range Information Management in the 21st Century
Hinton, G. Derrick; International Test and Evaluation Association (ITEA) Journal; July 2006, pp. 11-12; In English
Report No.(s): AD-A519791; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As the Global Information Grid becomes a reality, it is becoming less and less feasible to isolate a system under test, or a training participant, from the information-rich environment in which it operates. At issue is how Department of Defense ranges can effectively control and manage information across multiple access levels without compromising security, diminishing operational realism, or escalating the cost or complexity of effective range operations. Ranges have traditionally taken the system high approach to data handling when multiple classification levels are involved, immediately classifying all data at the highest level of any data involved and requiring all participants to operate at that level. While such an approach

mitigates the need for complex multiple security level processing, it can restrict the participation of systems and warfighters that cannot access data at the highest level. Seamlessly sharing data among participants with different clearance levels is clearly a high-priority goal of operational system and range infrastructure developers. The increased demand to train and fight with coalition partners, using a mixture of white-world and highly classified weapons and information, has led the operational community to grapple with how to implement multiple independent levels of security (MILS) to share data among warfighters possessing various clearance levels. The optimum approach to MILS is the implementation of Multilevel Security (MLS), in which a single processing device is designed to segment and route data to the appropriate end user at each node in the network. Chipsets and devices have been developed to facilitate a true MLS network topology, but accreditation of MLS systems has proven elusive, largely due to design costs and the intensive testing required to verify the fidelity of MLS devices. Due to the difficulty of implementing and accrediting MLS, many organizations have adopted a Multiple Security Levels (MSL) approach.
DTIC
Computer Information Security; Evaluation; Information Management; Land Management; Military Operations; Rangelands; Security; System Effectiveness

20100020312 Department of Defense, Bethesda, MD USA
Guide to Nongovernmental Organizations for the Military: A Primer for the Military About Private, Voluntary, and Nongovernmental Organizations Operating in Humanitarian Emergencies Globally
Frandsen, Grey; Lawry, Lynn; January 2009; 369 pp.; In English; Original contains color illustrations
Report No.(s): AD-A519436; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This book is about nongovernmental organizations (NGOs), often referred to as private voluntary organizations (PVOs), nonprofits, charities, and (humanitarian) aid organizations. Its aim is to orient the military with NGOs: their operations, strengths, limitations, budgets, practices, and other characteristics that make them unique actors in a large and dynamic humanitarian community. Every NGO is unique: no two have exactly the same objectives, missions, operating procedures, or capacities. To provide a cohesive body of information, generalizations are often made and detail may be sacrificed. This book has been produced specifically for uniformed services personnel, but it may prove useful to others in understanding some of the military-specific issues in foreign aid. The annexes in this book play an important part in constructing an understanding of NGOs and the NGO community. Designed as a quick reference, annex 2 is a compilation of the most informative websites highlighted in different sections of the book. Annex 1 covers the basics for NGOs commonly found in humanitarian emergencies around the world and ones the military are likely to encounter.
DTIC
Directories; Emergencies; Organizations

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20100019279 Naval Research Lab., Washington, DC USA
Unmanned Vehicle Mission Planning Using 4D Forecasts
Bourgeois, B S; Morris, H A; Jan 2008; 4 pp.; In English
Report No.(s): AD-A517898; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517898

We are engaged in the development of mission planning software for autonomous underwater vehicles (AUVs) supporting the Naval Oceanographic Office's underwater glider and AUV programs. Planning missions for underwater vehicles require the consideration of static features such as bathymetry, territorial boundaries, and shipping lanes and also time variant features such as water density, sea state, and currents that can be estimated using model forecasts. These myriad considerations result in a 4D x N geospatial- temporal constraint satisfaction problem, where N is the number of factors and D is typically represented as a value at a specific (x,y,z) location and time t. The difficulty inherent in this decision-making process is the simultaneous manipulation and visualization of these variables, which is accomplished today through human observation of

multiple 2D slices of the 4D x N cube. Another complicating factor is the large size of the forecast datasets, which can approach a gigabyte in size.
DTIC
Autonomous Navigation; Computer Programs; Forecasting; Mission Planning; Underwater Vehicles

20100019437 NASA Langley Research Center, Hampton, VA, USA
Update: Partnership for the Revitalization of National Wind Tunnel Force Measurement Technology Capability
Rhew, Ray D.; May 10, 2010; 9 pp.; In English; 7th International Symposium on Strain-Gauge Balances, 10-13 May 2010, Williamsburg, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 122711.03.09.07.02
Report No.(s): NF1676L-10681; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019437

NASA's Aeronautics Test Program (ATP) chartered a team to examine the issues and risks associated with the lack of funding and focus on force measurement over the past several years, focusing specifically on strain-gage balances. NASA partnered with the U.S. Air Force's Arnold Engineering Development Center (AEDC) to exploit their combined capabilities and take a national level government view of the problem and established the National Force Measurement Technology Capability (NFMTC) project. This paper provides an update on the team's status for revitalizing the government's balance capability with respect to designing, fabricating, calibrating, and using the these critical measurement devices.
Author
Wind Tunnel Tests; Test Facilities; Technology Utilization; Project Management; Measuring Instruments

20100019543
Vehicle Infrastructure Integration Proof of Concept Results and Findings Summary Vehicle
Andrews, S.; Cops, M.; May 19, 2009; 91 pp.; In English
Contract(s)/Grant(s): DTFH61-05-H-00003
Report No.(s): PB2010-109166; FHWA-JPO-09-043; Copyright; Avail.: National Technical Information Service (NTIS)

This document describes the objectives and the approach to the testing of the VII Proof of Concept system. A summary of the test results and findings for both the major system functions and the applications designed for the system, are presented along with recommendations for system improvements.
NTIS
Transportation; Vehicles

20100019557 VII Consortium, Novi, MI, USA
Vehicle Infrastructure Integration Proof of Concept Technical Description- Vehicle
Andrews, S.; Cops, M.; May 19, 2009; 106 pp.; In English
Contract(s)/Grant(s): DTFH61-05-H-00003
Report No.(s): PB2010-108460; FHWA-JPO-09-017; No Copyright; Avail.: National Technical Information Service (NTIS)

This report provides the technical description of the Vehicle Infrastructure Integration (VII) system developed for the Cooperative Agreement Program between the USA Department of Transportation (USDOT) and Vehicle Infrastructure Integration Consortium (VIIC). The basic architectural elements are summarized and detailed descriptions of the hardware and software systems are provided along with the descriptions of the applications used to assess the system.
NTIS
Transportation; Motor Vehicles

20100019558 VII Consortium, Novi, MI, USA
Vehicle Infrastructure Integration Proof of Concept Executive Summary - Vehicle
Andrews, S.; Cops, M.; May 19, 2009; 36 pp.; In English
Contract(s)/Grant(s): DTFH61-05-H-00003
Report No.(s): PB2010-108459; FHWA-JPO-09-003; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes a program of work resulting from a Cooperative Agreement between the USA Department of Transportation (USDOT) and the Vehicle Infrastructure Integration Consortium (VIIC) to develop and test a Proof of Concept (POC) Vehicle Infrastructure Integration (VII) system, based on Dedicated Short Range Communications (DSRC), a wireless communication between an infrastructure and mobile terminals. It supports applications for improvement in safety, mobility

and enables other commercial applications. Key findings and recommendations for further work are presented.
NTIS
Transportation; Wireless Communication; Motor Vehicles

20100019560 NASA Langley Research Center, Hampton, VA, USA
An Overview of the NASA Aeronautics Test Program Strategic Plan
Marshall, Timothy J.; May 10, 2010; 8 pp.; In English; 7th International Symposium on Strain-Gauge Balances, 10-13 May 2010, Williamsburg, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 122711.03.06.07
Report No.(s): NF1676L-10662; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019560

U.S. leadership in aeronautics depends on ready access to technologically advanced, efficient, and affordable aeronautics test capabilities. These systems include major wind tunnels and propulsion test facilities and flight test capabilities. The federal government owns the majority of the major aeronautics test capabilities in the USA, primarily through the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD), however an overarching strategy for management of these national assets was needed. Therefore, in Fiscal Year (FY) 2006 NASA established the Aeronautics Test Program (ATP) as a two-pronged strategic initiative to: (1) retain and invest in NASA aeronautics test capabilities considered strategically important to the agency and the nation, and (2) establish a strong, high level partnership with the DoD Test Resources Management Center (TRMC), stewards of the DoD test and evaluation infrastructure. Since then, approximately seventy percent of the ATP budget has been directed to underpin fixed and variable costs of facility operations within its portfolio and the balance towards strategic investments in its test facilities, including maintenance and capability upgrades. Also, a strong guiding coalition was established through the National Partnership for Aeronautics Testing (NPAT), with governance by the senior leadership of NASA s Aeronautics Research Mission Directorate (ARMD) and the DoD's TRMC. As part of its strategic planning, ATP has performed or participated in many studies and analyses, including assessments of major NASA and DoD aeronautics test capabilities, test facility condition evaluations and market research. The ATP strategy has also benefitted from unpublished RAND research and analysis by Ant n et al. (2009). Together, these various studies, reports and assessments serve as a foundation for a new, five year strategic plan that will guide ATP through FY 2014. Our vision for the future is a balanced portfolio of aeronautics ground and flight test capabilities that advance U.S. leadership in aeronautics in the short and long term. Key to the ATP vision is the concept of availability, not necessarily ownership; that is, NASA does not have to own and operate all facilities that are envisioned for future aeronautics testing. However, ATP will enable access to capabilities which are needed but not owned by NASA through strategic partnerships and reliance agreements. This paper will outline the major aspects of the ATP strategic plan for achieving its mission.
Author
NASA Programs; Aeronautics; Wind Tunnel Tests; Test Facilities; Management Planning

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20100018503 United Space Alliance, Houston, TX, USA
The International Space Station: Systems and Science
Giblin, Timothy W.; April 30, 2010; 88 pp.; In English; University of Missouri Alumni Physics luncheon, 30 Apr. 2010, Saint Louis, MO, USA; Original contains color illustrations
Report No.(s): JSC-CN-20612; Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018503

ISS Program Mission: Safely build, operate, and utilize a permanent human outpost in space through an international partnership of government, industry, and academia to advance exploration of the solar system, conduct scientific research, and enable commerce in space.
Author
International Space Station; Spacecrews; Solar System

20100018793 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Relative Orbit Elements for Satellites in Elliptical Orbits

Johnson, Kirk W; Mar 2010; 193 pp.; In English; Original contains color illustrations

Report No.(s): AD-A518143; AFIT/GA/ENY/10-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518143

The purpose of this research was to describe the unperturbed relative motion of Earth satellites in elliptical orbits using a simple dynamics model whose parameters allow significant geometrical insight and operational efficacy. The goal was to retain the advantages of the Relative Orbit Elements (ROE) realization of the Hill-Clohessy-Wiltshire (HCW) equations, a linearized dynamics model for circular reference orbits. Specifically, this thesis analyzed the geometry of satellite rendezvous and proximity operations using the ROE parameters to characterize the model's utility. Next, through a comprehensive literature review, this thesis sought possible approaches for developing a similarly useful parameterization for chief orbits with nonzero eccentricity. The approach selected was a novel linear time-varying system which requires both chief and deputy satellites to remain close to a virtual chief on a known circular orbit. The research derived and solved the equations of motion, expressing the solution in terms of simple geometric parameters. Numerical simulations compared the new model against both HCW and Keplerian two-body motion, revealing less accurate performance than HCW for some cases. Error analysis explained this behavior and found restricted regions where the new model performed accurately. Finally, this study identified new approaches for researching relative satellite motion on elliptical orbits.

DTIC

Artificial Satellites; Elliptical Orbits; Rendezvous Spacecraft; Trajectories

20100020137 NASA Marshall Space Flight Center, Huntsville, AL, USA

Display Tolerance Networking (DTN) Implementation and Utilization Options on the International Space Station

Holbrook, Mark; Pitts, Robert Lee; Gifford, Kevin K.; Jenkins, Andrew; Kuzminsky, Sebastian; April 25, 2010; 1 pp.; In English; SpaceOps Conference 2010, 25-30 Apr. 2010, Huntsville, AL, USA

Contract(s)/Grant(s): NNM04AA07C

Report No.(s): M10-0104; Copyright; Avail.: Other Sources; Abstract Only

The International Space Station (ISS) is in an operational configuration and nearing final assembly. With its maturity and diverse payloads onboard, the opportunity exists to extend the orbital lab into a facility to exercise and demonstrate Delay/Disruption Tolerant Networking (DTN). DTN is an end-to-end network service providing communications through environments characterized by intermittent connectivity, variable delays, high bit error rates, asymmetric links and simplex links. The DTN protocols, also known as bundle protocols, provide a store-and-forward capability to accommodate end-to-end network services. Key capabilities of the bundling protocols include: the Ability to cope with intermittent connectivity, the Ability to take advantage of scheduled and opportunistic connectivity (in addition to always up connectivity), Custody Transfer, and end-to-end security. Colorado University at Boulder and the Huntsville Operational Support Center (HOSC) have been developing a DTN capability utilizing the Commercial Generic Bioprocessing Apparatus (CGBA) payload resources onboard the ISS, at the Boulder Payload Operations Center (POC) and at the HOSC. The DTN capability is in parallel with and is designed to augment current capabilities. The architecture consists of DTN endpoint nodes on the ISS and at the Boulder POC, and a DTN node at the HOSC. The DTN network is composed of two implementations; the Interplanetary Overlay Network (ION) and the open source DTN2 implementation. This paper presents the architecture, implementation, and lessons learned. By being able to handle the types of environments described above, the DTN technology will be instrumental in extending networks into deep space to support future missions to other planets and other solar system points of interest. Thus, this paper also discusses how this technology will be applicable to these types of deep space exploration missions.

Author

International Space Station; Payloads; Bioprocessing; Space Missions; Space Exploration; Lessons Learned

20100020165 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Automated Planning and Scheduling for Space Mission Operations

Chien, Steve; Jonsson, Ari; Knight, Russell; February 28, 2005; 79 pp.; In English; Ground System Architectures Workshop (GSAW), 28 Feb. - 3 Mar. 2005, Manhattan Beach, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41515

Research Trends: a) Finite-capacity scheduling under more complex constraints and increased problem dimensionality (subcontracting, overtime, lot splitting, inventory, etc.) b) Integrated planning and scheduling. c) Mixed-initiative frameworks. d) Management of uncertainty (proactive and reactive). e) Autonomous agent architectures and distributed production

management. e) Integration of machine learning capabilities. f) Wider scope of applications: 1) analysis of supplier/buyer protocols & tradeoffs; 2) integration of strategic & tactical decision-making; and 3) enterprise integration.
Author
Autonomy; Space Missions; Planning; Decision Making; Operations Research

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20100018388 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
MEMS AO for Planet Finding
Rao, Shanti; Wallace, J. Kent; Shao, Mike; Schmidtlin, Edouard; Levine, B. Martin; Samuele, Rocco; Lane, Benjamin; Chakrabarti, Supriya; Cook, Timothy; Hicks, Brian; Jung, Paul; January 23, 2008; 58 pp.; In English; SPIE Photonics West, 23 Jan. 2008, San Jose, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41536

This slide presentation reviews a method for planet finding using microelectromechanical systems (MEMS) Adaptive Optics (AO). The use of a deformable mirror (DM) is described as a part of the instrument that was designed with a nulling interferometer. The strategy that is used is described in detail.
CASI
Adaptive Optics; Microelectromechanical Systems; Extrasolar Planets; Planet Detection; Imaging Techniques

20100018774 Naval Observatory, Washington, DC USA
U.S. Naval Observatory VLBI Analysis Center
Boboltz, David A; Fey, Alan L; Bartlett, Jennifer L; Dugan, Zachary; Kingham, Kerry A; Hall, David M; Jan 2008; 5 pp.; In English
Report No.(s): AD-A518087; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518087

This report summarizes the activities of the VLBI Analysis Center at the USA Naval Observatory for calendar year 2008. Over the course of the year, Analysis Center personnel analyzed biweekly 24-hour experiments with designations IVS-R1 and IVS-R4 for use in-house and continued timely submission of IVS-R4 databases for distribution to the IVS. During the 2008 calendar year, the USNO Analysis Center produced two periodic global Terrestrial Reference Frame (TRF) solutions with designations usn2008a and usn2008b. Earth orientation parameters (EOP) based on these solutions, updated by the latest 24-hour (IVS-R1 and IVS-R4) experiments, were submitted to the IVS. Other activities in the 2008 calendar year included the continued submission of Sinex files based on new 24-hour experiments to the IVS. For the Celestial Reference Frame (CRF), Analysis Center personnel continued a program designed to increase the sky density of ICRF sources, especially in the Southern Hemisphere. Activities included scheduling, analyzing and submitting databases for IVS-CRF experiments, and the production of global CRF solutions designated crf2008a and crf2008b. In addition, Analysis Center personnel performed research into the next generation ICRF-2 and a future high-frequency reference frame based on the VLBA K/Q-band experiments. Activities planned for the 2009 calendar year include the continued production of EOP/TRF/CRF global solutions and continued research into future reference frames.
DTIC
Astronomical Observatories; Interferometry; Observatories; Very Long Base Interferometry

20100018810 Naval Research Lab., Washington, DC USA
Vega is a Rapidly Rotating Star
Pauls, T A; Peterson, D M; Jan 2007; 7 pp.; In English
Report No.(s): AD-A518205; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518205

A star's most important attributes are its mass, temperature, radius, composition, and rate of rotation. The Sun, for example, rotates once every 28 days, which implies a surface speed of about 2 kilometers per second at the equator. However, there are stars that rotate over 100 times faster. NRL scientists have recently shown that Vega, the brightest star in the

constellation Lyra, is a member of this class of rapidly rotating stars. Due to its brightness, Vega has often been used as a standard for calibration purposes assuming it is a slowly rotating star, although there have been problems. The scientists have resolved these problems using the Navy Prototype Optical Interferometer to make observations showing that Vega is a rapid rotator with its axis of rotation pointing nearly directly at the earth. The techniques developed in the course of this work may someday be used to image objects in geosynchronous orbit.
DTIC
Interferometers; Optical Measurement; Rotation; Synchronous Satellites

20100018818 Naval Research Lab., Washington, DC USA
The STEREO Mission: A Three-Dimensional View of the Sun and Heliosphere
Cook, J W; Newmark, J S; Howard, R A; Jan 2007; 4 pp.; In English
Report No.(s): AD-A518222; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518222

Coronal mass ejections (CMEs) are massive outflows of material from the Sun's corona, traveling into the surrounding heliosphere at speeds up to 1000-2000 kilometers per second. When directed toward the Earth, CMEs can result in damage to satellites, enhanced auroral displays, blackouts of power grids on Earth, and interference with surface radio communications. The first CME detected from space was observed by an NRL coronagraph onboard the Seventh Orbiting Solar Observatory (OSO-7) in December 1971. Much of our recent knowledge of CMEs has been obtained from an NRL visible-light coronagraph (LASCO, the Large Angle Spectroscopic Coronagraph(2)) on the Solar and Heliospheric Observatory (SOHO) spacecraft, launched in 1995. But SOHO observes from only one viewpoint, leaving three-dimensional structure ambiguous for individual CMEs. The next step beyond SOHO is the Solar Terrestrial Relations Observatory (STEREO) mission, consisting of two spacecraft observing the Sun from two different viewpoints, allowing a three-dimensional view of the initiation of CMEs and their propagation outwards. In addition, STEREO will carry a new type of heliospheric coronagraph that is off-pointed from the solar disk, and can observe from the side the Sun-Earth line all the way out to Earth. The STEREO mission is meant to increase our understanding of such topics as solar structures and their properties involved in CME initiation; threedimensional structure and kinematics of CMEs; three-dimensional structure of active regions, coronal loops, and streamers; propagation of CMEs into the corona and interplanetary medium; and the effects of CMEs through the heliosphere to the Earth.
DTIC
Artificial Satellites; Coronal Mass Ejection; Heliosphere; Solar Corona; Solar Observatories; STEREO (Observatory); Sun

20100019168 NASA Johnson Space Center, Houston, TX, USA
Asteroidal Differentiation - The Record in Meteorites
Mittlefehldt, David W.; [2010]; 1 pp.; In English; Goldschmidt 2010, 13-18 Jun. 2010, Knoxville, TN, USA
Report No.(s): JSC-CN-20253; No Copyright; Avail.: Other Sources; Abstract Only

Early in solar system history, an intense energy source modified the small rocky bodies that had accreted from nebular condensates. The consensus view is that this energy source was the decay of short-lived 26Al, perhaps with a contribution from short-lived 60Fe. Differentiated meteorites and primitive achondrites preserve records of the states of asteroids as differentiation was ending. Reading these records provides clues to the nature of the energy source and the mechanisms of differentiation. I will examine the records from the acapulcoite-lordanite clan, ureilites, main-group pallasites, magmatic iron meteorite groups, brachinites and howardite-eucrite-diogenite (HED) clan meteorites. The acapulcoite-lodranite clan and the ureilites contain evidence that their parent asteroids reached temperatures where basaltic melts were produced. The mineralogies of lodranites and ureilites are dominantly olivine and low-Ca pyroxene, and these meteorites are highly depleted in incompatible lithophile elements. The acapulcoite-lodranite and ureilite parent bodies were heated to the point where on the order of 20-30% melting had taken place, but there is no evidence for more extensive melting. Assuming a 26Al energy source, the implication is that transport of the Al-rich basalt out of the mantle outpaced radiogenic heating, and thus shut down further differentiation. Main-group pallasites, magmatic iron meteorites and HED clan meteorites, on the other hand, provide evidence for total or near total melting of asteroids. The silicate phase of pallasites is magnesian olivine; their minor and trace element contents suggest that they are refractory melting residues. The degree of melting was high, perhaps on the order of 80%. The compositions of the most Ir-rich magmatic irons suggest near total melting of the metallic phase, and thus high degrees of melting on their parent asteroids. The compositions of basaltic eucrites are most consistent with them being residues from the crystallization of a largely molten asteroid. For these meteorite groups, the rate of heating outpaced the rate at which the melt could be extracted from the interiors, again, assuming 26Al was the energy source. The nature of the heat engine and asteroidal

differentiation processes will be discussed as they can be inferred from the petrology and composition of achondrites, irons and stony irons.
Author
Achondrites; Asteroids; Stony-Iron Meteorites; Meteoritic Composition; Iron Meteorites; Petrology; Radiogenic Materials

20100019176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A LISA Interferometry Primer
Thorpe, James Ira; [2010]; 1 pp.; In English; 8th International LISA Symposium, 28 Jun. - 2 Jul. 2010, Stanford, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

A key challenge for all gravitational wave detectors in the detection of changes in the fractional difference between pairs of test masses with sufficient precision to measure astrophysical strains with amplitudes on the order of approx.10(exp -21). ln the case of the five million km arms of LISA, this equates to distance measurements on the ten picometer level. LISA interferometry utilizes a decentralized topology, in which each of the sciencecraft houses its own light sources, detectors, and electronics. The measurements made at each of the sciencecraft are then telemetered to ground and combined to extract the strain experienced by the constellation as a whole. I will present an overview of LISA interferometry and highlight some of the key components and technologies that make it possible.
Author
Gravitational Waves; Interferometry; Telemetry; Astrophysics; Constellations

20100019244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Primordial Inflation Polarization Explorer (PIPER)
Chuss, David T.; [2010]; 1 pp.; In English; Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Primordial Inflation Polarization Explorer (PIPER) is a ba1loon-borne instrument designed to search for the faint signature of inflation in the polarized component of the cosmic microwave background (CMB). PIPER will measure the CMB polarization at 4 frequencies (l per flight) using a pair of cryogenic telescopes, one for measuring each of Stokes Q and U in the instrument frame. Each telescope receives both linear orthogonal polarizations in two 32 by 40 element planar arrays that utilize Transition-Edge Sensors (TES). The first element in each telescope is a variable-delay polarization modulator (VPM) that fully modulates the Stokes parameter to which the telescope is sensitive.
Author
Cosmic Microwave Background Radiation; Telescopes; Sensitivity; Cryogenics

20100019246 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Microshutter Arrays for the JWST NIRSpec
Moseley, Samuel H.; [2010]; 1 pp.; In English; JWST NIRSpec Training Team Meeting. ELIXIR Initial Training Network of European Commission, 30 May - 2 Jun. 2010, Ottobrunn, Germany; No Copyright; Avail.: Other Sources; Abstract Only

A primary goal of the James Webb Space Telescope (JWST) is to characterize the birth and evolution of galaxies by imaging and spectroscopic observations. The telescope will use a Near Infrared Camera and a Near Infrared Spectrometer (NIRSpec) to carry out this program. The 3.6' x 3.6' field of NIRSpec will contain thousands of candidate high redshift galaxies. With such a high candidate object density, simultaneous multi-object capability is essential. This capability requires a programmable object selection mask to eliminate sky background and to reduce source confusion caused. We are developing a two-dimensional programmable field mask for NIRSpec. These masks employ micromechanical (MEMS) techniques to provide source selection over the NIRSpec field of view. The first flight format arrays (171x365 shutters) have been fabricated and full functionality of these arrays has been demonstrated in lab tests.
Author
James Webb Space Telescope; Near Infrared Radiation; Galactic Evolution; Infrared Spectrometers; Imaging Techniques; Microelectromechanical Systems; Micromechanics; Red Shift

20100019267 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Afterglow Population Studies from Swift Follow-Up Observations of Fermi LAT GRBs
Racusin, Judith L.; Oates, S. R.; McEnery, J.; Vasileiou, V.; Troja, E.; Gehrels, N.; April 19, 2010; 1 pp.; In English; Deciphering the Ancient Universe with Gamma-ray Bursts, 19-23 Apr. 2010, Kyoto, Japan; Copyright; Avail.: Other Sources; Abstract Only

The small population of Fermi LAT detected GRBs discovered over the last year has been providing interesting and

unexpected clues into GRB prompt and afterglow emission mechanisms. Over the last 5 years, it has been Swift that has provided the robust data set of UV/optical and X-ray afterglow observations that opened many windows into other components of GRB emission structure. We explore the new ability to utilize both of these observatories to study the same GRBs over 10 orders of magnitude in energy, although not always concurrently. Almost all LAT GRBs that have been followed-up by Swift within 1-day have been clearly detected and carefully observed. We will present the context of the lower-energy afterglows of this special subset of GRBs that has > 100 MeV emission compared to the hundreds in the Swift database that may or may not have been observed by LAT, and theorize upon the relationship between these properties and the origin of the high energy gamma-ray emission.
Author
Gamma Ray Bursts; Afterglows; X Rays; Gamma Rays

20100019281 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Comparison of Oxidized Carbon Abundances among Comets
DiSanti, M. A.; Mumma, M. J.; Bonev, B. P.; Villanueva, G. L.; Radeva, Y. L.; Magee-Sauer, K.; Gibb, E. L.; [2010]; 1 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100019281

Comets contain relatively well preserved icy material remaining from the epoch of Solar System formation, however the extent to which these ices are modified from their initial state remains a fundamental question in cometary science. As a comet approaches the Sun, sublimation of the ices contained in its nucleus (termed ' native ices') releases parent volatiles into the coma, where they can be measured spectroscopically. One means of assessing the degree to which interstellar ices were processed prior to their incorporation into cometary nuclei is to measure the relative abundances of chemically-related parent volatiles. For example, formation of C2H6 by hydrogen atom addition (e.g., to C2H2) on surfaces of ice-mantled grains was proposed to explain the high C2H6 to CH4 abundance observed in C/1996 B2 (Hyakutake) [1]. The large C2H6/CH4 abundance ratios measured universally in comets, compared with those predicted by gas phase production of C2H6, establishes H-atom addition as an important and likely ubiquitous process. CO should also be hydrogenated on grain surfaces. Laboratory irradiation experiments on interstellar ice analogs indicate this to require very low temperatures (T approx. 10-25 K), the resulting yields of H2CO and CH3OH being highly dependent both on hydrogen density (i.e., fluence) and on temperature ([2],[3]). This relatively narrow range in temperature reflects a lack of mobility below 8-10 K on the one hand, and reduced sticking times for H-atoms as grain surfaces are warmed above 20 K on the other. The relative abundances of these three chemically-related molecules in comets provides one measure of the efficiency of H-atom addition to CO on pre-cometary grains (Fig. 1).
Author
Comet Nuclei; Carbon; Vapor Phases; Irradiation; Planetary Evolution

20100019284 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mechanisms of Ionospheric Mass Ejection
Moore, Thomas Earle; Khazanov, George V.; Hannah, Mei-Ching; Glocer, Alex; [2010]; 1 pp.; In English; 2010 Western Pacific Geophysics Meeting, 19-26 Jun. 2010, Taipei, Taiwan, Province of China; No Copyright; Avail.: Other Sources;
Abstract Only

Ionospheric outflows are directly responsive to solar wind disturbances, particularly in the dayside auroral cusp or cleft regions. Inputs of both electromagnetic energy (Poynting flux) and kinetic energy (particle precipitation) are closely correlated with these outflows. We assess the importance of processes thought to drive ionospheric outflows. These begin with the diffuse effects of photoionization and thermal equilibrium of the ionospheric topside, enhancing Jeans' escape, with ambipolar diffusion and acceleration. Auroral outflows begin with dayside reconnexion and resultant field-aligned currents and driven convection. These produce plasmaspheric plumes, collisional heating and wave-particle interactions, centrifugal acceleration, and auroral acceleration by parallel electric fields, including enhanced ambipolar fields from electron heating by precipitation particles. Solar wind energy dissipation is concentrated by the geomagnetic field into auroral regions with an amplification factor of 10-100, enhancing heavy species plasma and gas escape from gravity, and providing more current carrying capacity. Internal plasmas thus enable electromagnetic driving via coupling to the plasma and neutral gas. We assess the importance of each of these processes in terms of local escape flux production as well as global outflow, and suggest methods for their implementation within multi-species global simulation codes. We conclude by assessing outstanding obstacles to this objective.
Author
Auroral Zones; Energy Dissipation; Wave-Particle Interactions; Computerized Simulation; Solar Wind; Photoionization; Geomagnetism; Field Aligned Currents; Ambipolar Diffusion; Auroras

20100019316 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Interferometry in the Era of Very Large Telescopes

Barry, Richard K.; [2010]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Research in modern stellar interferometry has focused primarily on ground-based observatories, with very long baselines or large apertures, that have benefited from recent advances in fringe tracking, phase reconstruction, adaptive optics, guided optics, and modern detectors. As one example, a great deal of effort has been put into development of ground-based nulling interferometers. The nulling technique is the sparse aperture equivalent of conventional coronography used in filled aperture telescopes. In this mode the stellar light itself is suppressed by a destructive fringe, effectively enhancing the contrast of the circumstellar material located near the star. Nulling interferometry has helped to advance our understanding of the astrophysics of many distant objects by providing the spatial resolution necessary to localize the various faint emission sources near bright objects. We illustrate the current capabilities of this technique by describing the first scientific results from the Keck Interferometer Nuller that combines the light from the two largest optical telescopes in the world including new, unpublished measurements of exozodiacal dust disks. We discuss prospects in the near future for interferometry in general, the capabilities of secondary masking interferometry on very large telescopes, and of nulling interferometry using outriggers on very large telescopes. We discuss future development of a simplified space-borne NIR nulling architecture, the Fourier-Kelvin Stellar Interferometer, capable of detecting and characterizing an Earth twin in the near future and how such a mission would benefit from the optical wavelength coverage offered by large, ground-based instruments.

Author

Astronomical Interferometry; Spatial Resolution; Adaptive Optics; Astrophysics; Detection; Telescopes; Stellar Envelopes

20100019319 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Scientific Revolution: The Hubble and James Webb Space Telescopes

Gardner, Jonathan P.; April 05, 2010; 1 pp.; In English; SPIE Defense, Security and Sensing 2010, 5-9 Apr. 2010, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Astronomy is going through a scientific revolution, responding to a flood of data from the Hubble Space Telescope, other space missions, and large telescopes on the ground. In this talk, I will discuss some of the important discoveries of the last decade, from dwarf planets in the outer Solar System to the mysterious dark energy that overcomes gravity to accelerate the expansion of the Universe. The next decade will be equally bright with the newly refurbished Hubble and the promise of its successor, the James Webb Space Telescope. An infrared-optimized 6.5m space telescope, Webb is designed to find the first galaxies that formed in the early universe and to peer into the dusty gas clouds where stars and planets are born. With MEMS technology, a deployed primary mirror and a tennis-court sized sunshield, the mission presents many technical challenges. I will describe Webb's scientific goals, its design and recent progress in constructing the observatory. Webb is scheduled for launch in 2014.

Author

Dark Energy; Gas Giant Planets; Dwarf Planets; Hubble Space Telescope; James Webb Space Telescope; Infrared Telescopes; Spaceborne Telescopes

20100019325 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Fourier-Kelvin Stellar Interferometer (FKSI): Infrared Detection and Characterization of Exozodiacal Dust to Super-Earths, A Progress Report

Danchi, W.; [2010]; 1 pp.; In English; SPIE Astronomical Instrumentation: Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Fourier-Kelvin Stellar Interferometer (FKSI) is a structurally connected infrared space interferometer with 0.5 m diameter telescopes on a 12.5 m baseline, and is passively cooled to approx.60K. The FKSI operates in the thermal infrared from 3-8 microns in a nulling (or starlight suppressing) mode for the detection and characterization of exoplanets, debris disks, extrasolar zodiacal dust levels. The FKSI will have the highest angular resolution of any infrared space instrument ever made with its nominal resolution of 40 mas at a 5 micron center wavelength. This resolution exceeds that of Spitzer by a factor of 38 and JWST by a factor of 5. The FKSI mission is conceived as a 'probe class' or 'mid-sized' strategic mission that utilizes technology advances from flagship projects like JWST, SIM, Spitzer, and the technology programs of TPF-I/Darwin. During the past year we began investigating an enhanced version of FKSI with 1-2 m diameter telescopes, passively cooled to 40K, on a 20-m baseline, with a sunshade giving a +/- 45 degree Field-of-Regard. This enhanced design is capable of detecting and characterizing the atmospheres of many 2 Earth-radius super-Earths and a few Earth-twins. We will report progress on the

design of the enhanced mission concept and current status of the technologies needed for this mission.
Author
Infrared Interferometers; Zodiacal Dust; Telescopes; Extrasolar Planets; Detection; Angular Resolution; Infrared Radiation; Infrared Instruments

20100019459 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-Ray Variability of ULXs and the Mass of NGC 5408 X-1
Strohmayer, Todd; May 24, 2010; 1 pp.; In English; XMM-Newton 2010 Science Workshp: Ultra-Luminous X-Ray Sources and Middle Weight Black Holes, 24-26 May 2010, Madrid, Spain, Spain; No Copyright; Avail.: Other Sources; Abstract Only

Several of the brightest ULXs now have detections of characteristic variability timescales in the X-ray; including quasiperiodic oscillation and power spectral break frequencies. The best example at present is NGC5408 X-1, which has shown X-ray timing and spectral behavior closely analogous to that observed in Galactic, stellar mass black holes, but at systematically higher luminosities and longer timescales. I will present recent XMM-Newton observations of X-1 that reveal a QPO frequency -- spectral index relationship consistent with that seen in stellar-mass black hole systems of known mass. I will show that extension of the frequency -- spectral index scaling relationship from the stellar-mass systems to X-1 suggests that it harbors an intermediate mass black hole. I will also present the results of regular, ongoing monitoring of X-1 with Swift, including the discovery of an 113 day periodicity that is likely the orbital period of the black hole binary.
Author
Black Holes (Astronomy); Galactic Mass; Oscillations; Stellar Mass; X Rays; Luminosity

20100019690 Naval Academy, Annapolis, MD USA
Observed Brightness Distributions in Overcast Skies
Lee, Jr, Raymond L; Devan, David E; Apr 2008; 13 pp.; In English
Contract(s)/Grant(s): NSF-ATM-0540896
Report No.(s): AD-A518983; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518983

Beneath most overcasts, clouds' motions and rapidly changing optical depths complicate mapping their angular distributions of luminance Lv and visible-wavelength radiance L. Fisheye images of overcast skies taken with a radiometer-calibrated digital camera provide a useful new approach to solving this problem. Maps calculated from time-averaged images of individual overcasts not only show their brightness distributions in unprecedented detail, but they also help solve a long-standing puzzle about where brightness maxima of overcasts are actually located. When combined with simulated radiance distributions from MODTRAN4, our measured radiances also let us estimate the gradients of cloud thickness observed in some overcasts.
DTIC
Asymmetry; Brightness; Brightness Distribution; Cloud Cover; Radiance; Thickness

20100019691 Naval Academy, Annapolis, MD USA
Measuring Overcast Colors with All-Sky Imaging
Lee, Jr, Raymond L; Apr 2008; 11 pp.; In English
Contract(s)/Grant(s): NSF-ATM-0540896
Report No.(s): AD-A518985; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518985

Digital images of overcast skies as seen from the earth's surface open new windows onto the angular details of overcast colors and visible-wavelength spectra. After calibration with a spectroradiometer, a commercial CCD camera equipped with a fisheye lens can produce colorimetrically accurate all-sky maps of overcast spectra. Histograms and azimuthally averaged curves of the resulting chromaticities show consistent, but unexpected, patterns in time-averaged overcast colors. Although widely used models such as LOWTRAN7 and MODTRAN4 cannot explain these characteristic patterns, a simple semiempirical model based on the radiative transfer equation does, and it provides insights into the visible consequences of absorption and scattering both within and beneath overcasts.
DTIC
Azimuth; Cloud Cover; Color; Colorimetry; Imaging Techniques; Lenses; Radiative Transfer; Spectroheliographs; Spectroradiometers

20100019789 Naval Observatory, Washington, DC USA
UCAC3 Pixel Processing
Zacharias, Norbert; Jun 2010; 11 pp.; In English
Report No.(s): AD-A519258; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519258

The third US Naval Observatory CCD Astrograph Catalog, UCAC3, was released at the IAU General Assembly on 2009 August 10. It is a highly accurate, all-sky astrometric catalog of about 100 million stars in the R = 8-16 mag range. Recent epoch observations are based on over 270,000 CCD exposures, which have been reprocessed for the UCAC3 release applying traditional and new techniques. Challenges in the data have been high dark current and asymmetric image profiles due to the poor charge transfer efficiency of the detector. Non-Gaussian image profile functions were explored and correlations are found for profile fit parameters with properties of the CCD frames. These were utilized to constrain the image profile fit models and adequately describe the observed point-spread function of stellar images with a minimum number of free parameters. Using an appropriate model function, blended images of double stars could be fit successfully. UCAC3 positions are derived from two-dimensional image profile fits with a five-parameter, symmetric Lorentz profile model. Internal precisions of about 5 mas per coordinate and single exposure are found, which are degraded by the atmosphere to about 10 mas. However, systematic errors exceeding 100 mas are present in the x, y data which have been corrected in the astrometric reductions following the x, y data reduction step described here.
DTIC
Astrography; Astronomical Observatories; Astronomy; Catalogs (Publications); Charge Coupled Devices; Image Processing; Optical Equipment; Pixels

20100019795 Naval Observatory, Washington, DC USA
UCAC3: Astrometric Reductions
Finch, Charlie T; Zacharias, Norbert; Wycoff, Gary L; Jun 2010; 9 pp.; In English
Report No.(s): AD-A519276; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA519276

Presented here are the details of the astrometric reductions from the x, y data to mean right ascension (R.A.), declination (decl.) coordinates of the third U.S. Naval Observatory CCD Astrograph Catalog (UCAC3). For these new reductions we used over 216,000 CCD exposures. The Two-Micron All-Sky Survey (2MASS) data are used extensively to probe for coordinate and coma-like systematic errors in UCAC data mainly caused by the poor charge transfer efficiency of the 4K CCD. Errors up to about 200 mas have been corrected using complex look-up tables handling multiple dependences derived from the residuals. Similarly, field distortions and sub-pixel phase errors have also been evaluated using the residuals with respect to 2MASS. The overall magnitude equation is derived from UCAC calibration field observations alone, independent of external catalogs. Systematic errors of positions at the UCAC observing epoch as presented in UCAC3 are better corrected than in the previous catalogs for most stars. The Tycho-2 catalog is used to obtain final positions on the International Celestial Reference Frame. Residuals of the Tycho-2 reference stars show a small magnitude equation (depending on declination zone) that might be inherent in the Tycho-2 catalog.
DTIC
Astrometry; Astronomy

20100019901 Communications Research Lab., Ibaraki, Japan
Pulsar Astrometry by Using VLBl (PSR0329 between Kashima 26mo & Usuda 64mo)
Hama, S; Kiuchi, H; Hanado, Y; Takahshi, Y; Imae, M; Fujlsawa, K; Hirabayashi, H; Kobayashi, H; Dec 1992; 9 pp.; In English
Report No.(s): AD-A519417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Communications Research Laboratory (CRL), carried out and VLBi (Very Long Baseline Interferometer) experiment of the pulsar 0329 + 54 on November in 1992 between Kashima 26md and Usuda 64md. We got a correlation for it by using K-3 VLBi correlator, which was developed by CRL. Though we observed a slow pulsar this time, we are going to make millisecond pulsar experiments by making good use of this result and by using K-4 correlator which is under developing in CRL. Its result will give us precise positions and proper motions of pulsars which are useful for obtaining precise pulsar timing.
DTIC
Accuracy; Astrometry; Pulsars

20100019915 Naval Observatory, Washington, DC USA

The Joint Milli-Arcsecond Pathfinder Survey: Introduction and Applications

Gaume, Ralph A; Dorland, Bryan N; Jan 2009; 6 pp.; In English; Original contains color illustrations

Report No.(s): AD-A519447; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Navy is developing the space-based Joint Milli-Arcsecond Pathfinder Survey mission (JMAPS) mission to support current and future needs for high accuracy star positions. The primary objective of the JMAPS mission is to generate a star catalog that is 15 times more accurate and 100 times denser than existing bright star catalogs. JMAPS will not only provide required star positions needed by high-accuracy, space-based orientation/attitude users, but JMAPS will also pathfind, mature, and risk-reduce technology for the next generation of high accuracy attitude determination systems. In addition, the JMAPS sensor, optimized to make very high precision measurements of star positions (astrometry), is ideally suited to improve position measurements of satellites and support formation flying applications. We will discuss the status of the JMAPS mission, including the current mission baseline, leading up to a CY 2013 launch.

DTIC

Artificial Satellites; Astrometry; Astronomy; Observatories; Surveys

20100020149 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Simple Model for the Evolution of Multi-Stranded Coronal Loops

Fuentes, M. C. Lopez; Klimchuk, J. A.; [2010]; 30 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100020149

We develop and analyze a simple cellular automaton (CA) model that reproduces the main properties of the evolution of soft X-ray coronal loops. We are motivated by the observation that these loops evolve in three distinguishable phases that suggest the development, maintainance, and decay of a self-organized system. The model is based on the idea that loops are made of elemental strands that are heated by the relaxation of magnetic stress in the form of nanoflares. In this vision, usually called 'the Parker conjecture' (Parker 1988), the origin of stress is the displacement of the strand footpoints due to photospheric convective motions. Modeling the response and evolution of the plasma we obtain synthetic light curves that have the same characteristic properties (intensity, fluctuations, and timescales) as the observed cases. We study the dependence of these properties on the model parameters and find scaling laws that can be used as observational predictions of the model. We discuss the implications of our results for the interpretation of recent loop observations in different wavelengths. Subject headings: Sun: corona - Sun: flares - Sun: magnetic topology - Sun: X-rays, gamma rays

Author

Coronal Loops; Gamma Rays; Plasmas (Physics); Strands; Coronas

20100020166 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Fast Switching and Precision Relative Astrometry at the DSN

Majid, Walid; Bagri, Durgadas; January 28, 2008; 16 pp.; In English; Institute of Navigation National Technical Meeting 2008, 28-30 Jan. 2008, San Diego, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41539

A) We are developing new techniques to improve astrometric accuracy: 1) Reducing switching time (approx. 60s) and angular separation (approx.1deg) between quasars; 2) Use of phase delay & bandpass calibration; 3) Techniques also applicable with future DSN Array. B) Initial set of observations carried out at the DSN show great promise. C) Continue DSN observations using fainter calibrators to study robustness and to verify and validate error estimates. (Eventually demo technique with spacecraft measurements). D) Viability of technique depends on existence of sufficient number of calibrators. (Determining what fraction of radio sources are compact at the VLBA) E) May be able to use calibrators with flux density approx. 50 mJy with calibrator <distance> 1deg. G) Relative precision of approx.0.5 nrad may be achievable. E) Absolute measurement always depends on knowledge of calibrator position. (Catalog maintained and improved).

Author

Astrometry; Error Analysis; Radiant Flux Density; Active Galactic Nuclei; Very Long Baseline Array (VLBA); Switching; Calibrating; Precision; Robustness (Mathematics)

20100020169 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Mars Public Engagement Overview

Johnson, Christine; June 25, 2009; 16 pp.; In English; High Energy Neutron Detector (HEND), 25 Jun. 2005, Moscow, Russia; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41519

This viewgraph presentation reviews the Mars public engagement goal to understand and protect our home planet, explore the Universe and search for life, and to inspire the next generation of explorers. Teacher workshops, robotics education, Mars student imaging and analysis programs, MARS Student Imaging Project (MSIP), Russian student participation, MARS museum visualization alliance, and commercialization concepts are all addressed in this project.

CASI

Mars (Planet); NASA Programs; General Overviews; Imaging Techniques

20100020170 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Hybrid Gibbs Sampling and MCMC for CMB Analysis at Small Angular Scales

Jewell, Jeffrey B.; Eriksen, H. K.; Wandelt, B. D.; Gorski, K. M.; Huey, G.; O'Dwyer, I. J.; Dickinson, C.; Banday, A. J.; Lawrence, C. R.; January 28, 2008; 14 pp.; In English; Cosmic Microwave Radiation, 27 Jan. - 2 Feb. 2008, Aspen, CO, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41541

A) Gibbs Sampling has now been validated as an efficient, statistically exact, and practically useful method for 'low-L' (as demonstrated on WMAP temperature polarization data). B) We are extending Gibbs sampling to directly propagate uncertainties in both foreground and instrument models to total uncertainty in cosmological parameters for the entire range of angular scales relevant for Planck. C) Made possible by inclusion of foreground model parameters in Gibbs sampling and hybrid MCMC and Gibbs sampling for the low signal to noise (high-L) regime. D) Future items to be included in the Bayesian framework include: 1) Integration with Hybrid Likelihood (or posterior) code for cosmological parameters; 2) Include other uncertainties in instrumental systematics? (I.e. beam uncertainties, noise estimation, calibration errors, other).

Author

Bayes Theorem; Cosmology; Calibrating; Microwave Anisotropy Probe

20100020215 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The HST/ACS Coma Cluster Survey. II. Data Description and Source Catalogs

Hammer, Derek; Kleijn, Gijs Verdoes; Hoyos, Carlos; Den Brok, Mark; Balcells, Marc; Ferguson, Henry C.; Goudfrooij, Paul; Carter, David; Guzman, Rafael; Peletier, Reynier F.; Smith, Russell J.; Graham, Alister W.; Trentham, Neil; Peng, Eric; Puzia, Thomas H.; Lucey, John R.; Jogee, Shardha; Aguerri, Alfonso L.; Batcheldor, Dan; Bridges, Terry J.; Davies, Jonathan I.; Del Burgo, Carlos; Erwin, Peter; Hornschemeier, Ann; Hudson, Michael J.; March 23, 2010; 27 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-26555; NNX07AH15G; NNG04GB78A; HST-GO-10861; HST-E0-10861.35-A; PP/E001149/1; AYA2006-12955; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100020215

The Coma cluster, Abell 1656, was the target of a HST-ACS Treasury program designed for deep imaging in the F475W and F814W passbands. Although our survey was interrupted by the ACS instrument failure in early 2007, the partially-completed survey still covers approximately 50% of the core high density region in Coma. Observations were performed for twenty-five fields with a total coverage area of 274 aremin(sup 2), and extend over a wide range of cluster-centric radii (approximately 1.75 Mpe or 1 deg). The majority of the fields are located near the core region of Coma (19/25 pointings) with six additional fields in the south-west region of the cluster. In this paper we present SEXTRACTOR source catalogs generated from the processed images, including a detailed description of the methodology used for object detection and photometry, the subtraction of bright galaxies to measure faint underlying objects, and the use of simulations to assess the photometric accuracy and completeness of our catalogs. We also use simulations to perform aperture corrections for the SEXTRACTOR Kron magnitudes based only on the measured source flux and its half-light radius. We have performed photometry for 76,000 objects that consist of roughly equal numbers of extended galaxies and unresolved objects. Approximately two-thirds of all detections are brighter than F814W=26.5 mag (AB), which corresponds to the 10sigma, point-source detection limit. We estimate that Coma members are 5-10% of the source detections, including a large population of compact objects (primarily GCs, but also cEs and UCDs), and a wide variety of extended galaxies from cD galaxies to dwarf low surface brightness galaxies. The initial data release for the HST-ACS Coma Treasury program was made available to the public in August 2008.

The images and catalogs described in this study relate to our second data release.
Author
Galactic Clusters; Hubble Space Telescope; Astronomical Catalogs; Astrometry; Point Sources

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20100018698 Army Space and Missile Defense Command, Huntsville, AL USA
Space Climate and the Military Decision Making Process in Solar Cycle 24
Godshall, Stacy; Jan 2008; 7 pp.; In English
Report No.(s): AD-A517914; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517914

January 2008 was the beginning of a new solar cycle called solar cycle 24. In this new 11 year cycle, as with all solar cycles, the sun will have an increase in magnetic activity until the maximum is reached in about 2012 or 2013, and then decrease until about 2019 when minimum will be reached. This type of dynamic activity in the sun has been visibly manifested for centuries in the number of sunspots on the sun, with the maximum of the cycle corresponding to the maximum of the number of sunspots. The maximum of solar cycle 24 will possibly have a peak 30-50 percent greater than the peak of solar cycle 23 as depicted in Figure 1 [Dikpati, et al, 2006; Phillips and Hathaway, 2006], and thus it will possibly be an intense cycle for geomagnetic storms. As mentioned, these cycles have been the object of study for scientists for centuries. What has not occurred in centuries past however is the analysis of the solar cycle and its impact on military operations. This is obvious since no military operations have needed to incorporate the solar cycle and its dynamics into planning since it generally had no effect on operations. Times have changed and the military has extensively utilized Space assets in operations for approximately the last twenty years. Thus for two solar cycles, specifically cycles 22 and 23, we have incorporated Space weather into mission analysis. Weather in general has had significant impact on operations since warfare began; either benefiting one force or the other. The following are just a few examples of such operational impacts created by weather conditions. In 1915, German forces use of poison gas and wind blew the chemicals back onto German lines and destroyed four Prussian regiments. In 1944, the D-Day weather forecast was for conditions favorable to air, sea and ground operations together ? a rare event.
DTIC
Aerospace Environments; Climate; Decision Making; Military Operations; Solar Cycles

20100018757 Frequency Electronics, Inc., Mitchel AFB, NY USA
What We Don't Know About Quartz Clocks in Space
Bloch, M; Mancini, O; McClelland, T; Nov 2009; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A518055; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518055

An essential element of any space vehicle is the onboard clock. The proper operation of the entire payload is dependent on the performance of the onboard clock or master oscillator. However, there is a noticeable absence of crucial data in the space community regarding space environmental effects as well as circuitry contributions on the performance of quartz clocks. For example, the authors, in a previous paper, presented empirical data on dormant quartz oscillators (redundant/stand-by units that are activated in the event of an anomaly in the primary oscillator) to determine the long-term aging performance of oscillators in the non-operating mode. The aging rate data are extremely important for predicting the expected performance of these backup oscillators after 10 or 15 years in space. This paper is an extension of this previous publication, in which other phenomena that may affect the performance of clocks in space are addressed. Issues such as acceleration, spacecraft charging, discharges from floating metal, solar flares, single event upsets, operating temperature, magnetic fields, space debris, and meteorite impacts are addressed. Typically, the theoretical response of quartz clocks to stimuli such as these is fairly well understood; however, the magnitudes of the stimuli on particular spacecraft platforms are not. Analyses suggest that quartz clock performance in space may or may not be significantly degraded due to these phenomena, depending on their magnitudes. This paper is intended to explore ideas and stimulate thought in the space community with the goal of launching more robust clocks in the future.
DTIC
Aerospace Environments; Clocks; Quartz

20100018951 Naval Research Lab., Washington, DC USA

Active Control of Nuclear-Enhanced Radiation Belts

Ganguli, G I; Lampe, M; Amatucci, W E; Streltsov, A V; Jan 2006; 4 pp.; In English

Report No.(s): AD-A518538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A high-altitude nuclear detonation by a hostile power could flood the Earth's radiation belts with MeV killer electrons, which would remain trapped by the earth's geomagnetic field for years. This orders-of-magnitude enhancement of the normal radiation belts would disable low-Earth-orbit satellites within weeks, thereby degrading military capabilities and severely impacting the economy. Development of an effective countermeasure is a national priority. NRL recognized the importance of this threat early on and initiated a comprehensive program in FY04 that includes theory, computer simulation, and laboratory experiments. We are developing quantitative physics models that are needed as a precursor to space-based tests. The ultimate objective is to avoid catastrophic radiation damage to space assets by restoring the radiation belt to its natural state within a week. There is every reason to believe that the killer nuclear-generated electrons could be precipitated if it were possible to introduce a sufficiently energetic spectrum of waves with the right wavelength and frequency. Mainline remediation efforts emphasize the use of whistler waves transmitted from a space-based antenna and amplified by the free energy available within the radiation belt. A technical panel in 2001 concluded that remediation could be achieved within a week using this method. A radically different approach for rapid remediation is based on massive injection of energy over a short duration. If a large quantity of neutral vapor, such as lithium, is released from a satellite moving in the equatorial plane, the vapor is photoionized over a period of about an hour. The resulting ions spin up into a highly unstable ring distribution, which emits large amplitude electromagnetic waves in the desired frequency and wavelength range. These waves can precipitate the killer electrons within hours, as opposed to a week.

DTIC

Active Control; Artificial Satellites; Countermeasures; Damage; High Altitude; Lithium; Low Earth Orbits; Nuclear Explosions; Nuclear Radiation; Radiation Belts; Radiation Damage; Whistlers

20100019045 Bureau International des Poids et Mesures, Sevres, France

Relativistic Theory for Syntonization of Clocks in the Vicinity of the Earth

Wolf, P; Petit, G; Dec 1994; 12 pp.; In English

Report No.(s): AD-A518813; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A well known prediction of Einstein's general theory of relativity states that two ideal clocks that move with a relative velocity, and are submitted to different gravitational fields will, in general, be observed to run at different rates. Similarly the rate of a clock with respect to the coordinate time of some spacetime reference system is dependent on the velocity of the clock in that reference system and on the gravitational fields it is submitted to. For the syntonization of clocks and the realization of coordinate times (like TM) this rate shift has to be taken into account at an accuracy level which should be below the frequency stability of the clocks in question, i.e. all terms that are larger than the instability of the clocks should be corrected for. We present a theory for the calculation of the relativistic rate shift for clocks in the vicinity of the Earth, including all terms larger than one part in 10(18). This, together with previous work on clock synchronization (Petit & Wolf 1993, 1994), amounts to a complete relativistic theory for the realization of coordinate time scales at picosecond synchronization and 10(-18) syntonization accuracy, which should be sufficient lo accommodate future developments in time transfer and clock technology.

DTIC

Clocks; Gravitational Fields; Relativistic Theory; Syntony

20100019187 Boston Coll., Chestnut Hill, MA USA

Comprehensive Methods for Determining Space Effects on Air Force Systems

Doherty, Paticia H; Midey, Anthony J; Miller, Thomas M; Levandier, Dale J; Holeman, Ernest; Webb, David F; Martin, Kevin; Aug 4, 2009; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-04-C-0006; Proj-5021

Report No.(s): AD-A518747; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Boston College Institute for Scientific Research has performed innovative research and analysis to increase the knowledge of space effects on Air Force systems. Sections in this report address a wide range of efforts from applying chemical techniques to the development of new technologies for Air Force space-based systems to developing a database of various measurements made by the Defense Meteorological Satellite Program (DMSP). In addition, our research explored solar and interplanetary disturbances and their coupling to geomagnetic storms. Another study involved research and development of highly miniaturized satellite skin sensor technology capable of measuring ionospheric neutral particles. This real-time, in-situ capability enables distributed, remote density measurements via small satellites including the Air Force

C/NOFS (Communications/Navigation Outage Forecast System) satellite mission. All aspects of the research process were included in our efforts. From data acquisition, analysis, theoretical explanation, database development to summary of our efforts. Much of our work was published in peer reviewed journals as evidenced in Section 7 with more than 45 publications over the course of this contract.
DTIC
Reaction Kinetics; Solar Activity

20100019243 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observing Mergers of Non-Spinning Black-Hole Binaries
McWilliams, Sean; Kelly, Bernard; Baker, John; [2010]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

Advances in the field of numerical relativity now make it possible to calculate the final, most powerful merger phase of binary black-hole coalescence for generic binaries ' The state of the art has advanced well beyond the equal-mass case into the unequal-mass and spinning regions of parameter space. We present a study of the nonspinning portion of parameter space, primarily using an analytic waveform model tuned to available numerical data, with an emphasis on observational implications. We investigate the impact of varied mass ratio on merger signal-to-noise ratios (SNRs) for several detectors, and compare our results with expectations from the test-mass limit. We note a striking similarity of the waveform phasing of the merger waveform across the available mass ratios. Motivated by this, we calculate the match between our 1:1 (equal mass) and 4:1 mass-ratio waveforms during the merger as a function of location on the source sky, using a new formalism for the match that accounts for higher harmonics. This is an indicator of the amount of degeneracy in mass ratio for mergers of moderate-mass-ratio systems
Author
Mass Ratios; Black Holes (Astronomy); Signal to Noise Ratios; Waveforms; Coalescing; Relativity

20100019248 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Evolution of Interplanetary Shocks and their CME Drivers
Gopalswamy, Natchimuthuk; [2010]; 1 pp.; In English; 216th American Astronomical Society Meeting, 20-26 Jun. 2010, Taipei, Taiwan, Province of China; No Copyright; Avail.: Other Sources; Abstract Only

Shock-driving coronal mass ejections (CMEs) constitute the most energetic phenomena in the heliosphere. The shocks can be identified in a number of ways based on remote-sensing and in situ observations. Type II radio bursts are the earliest indicators of shocks that accelerate electrons to energies up to -10 keV. Solar energetic particle (SEP) events are always accompanied by long wavelength type II bursts indicating that the same shock accelerates ions and electrons. A recent investigation involving a large number of interplanetary (IP) shocks revealed that about 35% of them do not produce type II bursts (radio quiet, RQ) or SEPs. Comparison of the RQ shocks with the radio loud (RL) ones revealed some interesting results such as: (1) the lack of evidence for blast waves,(2) energetic particle enhancement in the shock front in -20% of RQ shocks, and (3) determination of the difference between the RQ and RL shocks in terms of the different kinematic properties of the associated CMEs. On the other hand the shock properties measured at I AU are not too different for the RQ and RL cases. This can be attributed to the interaction with the IP medium, which seems to erase the difference. Implications of this evolution for the geoeffectiveness is also discussed.
Author
Coronal Mass Ejection; Solar Corpuscular Radiation; Interplanetary Shock Waves; Energetic Particles; Radio Bursts; Shock Fronts; Solar Flares

20100019250 NASA Goddard Space Flight Center, Greenbelt, MD, USA
What Do High-Resolution EIT Waves Tell Us About CMEs?
Thompson, Barbara; May 23, 2010; 1 pp.; In English; 216th American Astronomical Society (AAS) Meeting, 23-27 May 2010, Miami, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Although many studies have demonstrated that some coronal waves are not generated by corona) mass ejections, we have learned a great deal about the ability of corona) mass ejections to drive large-scale corona) waves, also called 'EIT waves.' We present new results based on EIT wave amplitude, timing, speed, and direction of propagation, with respect to their correlation with CME-related dimmings, speeds, locations and widths. Furthermore, we demonstrate the ability to correlate different aspects of EIT waves with some of the observed structure of CMEs observed in coronagraph data. Finally, we expand on the discussion of the types of wave modes that can be generated by a corona) mass ejection, and how these observations

can serve as a diagnostic of the type of impulse a CME can deliver to the surrounding corona. These diagnostics are obtained by examining the motion of individual field lines, requiring high-resolution observations like those provided by TRACE and SDO/AIA.
Author
High Resolution; Coronas; Coronagraphs; Coronal Mass Ejection

20100019277 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Exoplanet HAT-P-11b Secondary Transit Observations
Barry, Richard K., Jr.; [2010]; 1 pp.; In English; Exoplanet HAT-P-11b Secondary Transit Observations, 23-27 Aug. 2010, Nice, France; No Copyright; Avail.: Other Sources; Abstract Only

We have conducted secondary eclipse observations of exoplanet HAT--11b, recently discovered by proposal G. Bakos and his colleagues. HAT-P-11b is the smallest transiting extrasolar planet yet found and one of only two known exo-Neptunes. We have observed the system at 3.6 microns for a period of 22 hours centered on the anticipated secondary eclipse time, to detect the eclipse and determine its phase. Once the secondary eclipse is located through analysis of the data, we will make a more focused series of observations in both the 3.6 and 4.5 micron bands to fully characterize it. HAT-P-1lb has a period of 4.8878 days, radius of 0.422 RJ, mass of 0.081 MJ and semi major axis 0.053 AU. Measurements of the secondary eclipse will clarify two key issues; 1) the planetary brightness temperature and the nature of its atmosphere, and 2) the eccentricity of its orbit, with implications for its dynamical evolution. A precise determination of the orbit phase for the secondary eclipse will also be of great utility for Kepler observations of this system at visible wavelengths.
Author
Extrasolar Planets; Planetary Temperature; Brightness Temperature; Eccentricity

20100019278 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The GEMS X-Ray Polarimeter: Instrument Concept and Calibration Requirements
Jahoda, Keith; April 12, 2010; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The instrument and detector concepts for the Gravity and Extreme Magnetism Small Explorer (GEMS) X-ray polarimetry mission will be presented. The calibration requirements for astrophysical X-ray polarimeters in general and GEMS in particular will be discussed.
Author
Astrophysics; Polarimeters; X Rays; Calibrating

20100019280 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Geometric Model of a Coronal Cavity
Kucera, Therese A.; Gibson, S. E.; Ratawicki, D.; Dove, J.; deToma, G.; Hao, J.; Hudson, H. S.; Marque, C.; McIntosh, P. S.; Reeves, K. K.; Schmidt, D. J.; Sterling, A. C.; Tripathi, D. K.; Williams, D. R.; Zhang, M.; May 23, 2010; 1 pp.; In English; 216th American Astonomical Society (AAS) Meeting, 23-27 May 2010, Miami, FL, USA; Copyright; Avail.: Other Sources; Abstract Only

We observed a coronal cavity from August 8-18 2007 during a multi-instrument observing campaign organized under the auspices of the International Heliophysical Year (IHY). Here we present initial efforts to model the cavity with a geometrical streamer-cavity model. The model is based the white-light streamer mode] of Gibson et a]. (2003), which has been enhanced by the addition of a cavity and the capability to model EUV and X-ray emission. The cavity is modeled with an elliptical cross-section and Gaussian fall-off in length and width inside the streamer. Density and temperature can be varied in the streamer and cavity and constrained via comparison with data. Although this model is purely morphological, it allows for three-dimensional, multi-temperature analysis and characterization of the data, which can then provide constraints for future physical modeling. Initial comparisons to STEREO/EUVI images of the cavity and streamer show that the model can provide a good fit to the data. This work is part of the effort of the International Space Science Institute International Team on Prominence Cavities
Author
Coronas; Extreme Ultraviolet Radiation; Cavities

20100019285 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Kuiper Belt, Exozodiacal Dust, Debris Disks: It's All About Collisions
Kuchner, Marc; April 26, 2010; 1 pp.; In English; Kavli Institute of Theoretical Physics Meeting, 26 Apr. 2010, Santa Barbara, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Debris disks around other stars, like the disks around Fomalhaut, Vega, and Epsilon Eridani, are often described as more

massive versions of the Kuiper Belt. But for a long time, it's been hard to test this notion, because grain-grain collisions dominate the grain lifetimes and we lacked the tools to model the effect of collisions on the appearance of the disks. I'll describe a new breakthrough that has allowed us to make 3-D models of collisions in debris disks and exozodiacal clouds for the first time, and I'll show the latest supercomputer simulations of these systems, illustrating the effects of planets and collisions in sculpting these disks. These models will be the key to interpreting debris disk images from HST, Herschel, SOFIA, JWST, and ALMA, as well as understanding the exozodiacal dust backgrounds for direct imaging of exo-Earths.
Author
Debris; Kuiper Belt; Dwarf Stars; Three Dimensional Models; K Stars; SOFIA (Airborne Observatory); Dust

20100019286 NASA Goddard Space Flight Center, Greenbelt, MD, USA
WISPIR: A Wide-Field Imaging SPectrograph for the InfraRed for the SPICA Observatory
Benford, Dominic J.; Mundy, Lee G.; [2010]; 3 pp.; In English; Observational Frontiers of Astronomy for the New Decade, 27 Jun. - 2 Jul. 2010, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We have undertaken a study of a far infrared imaging spectrometer based on a Fourier transform spectrometer that uses well-understood, high maturity optics, cryogenics, and detectors to further our knowledge of the chemical and astrophysical evolution of the Universe as it formed planets, stars, and the variety of galaxy morphologies that we observe today. The instrument, Wide-field Imaging Spectrometer for the InfraRed (WISPIR), would operate on the SPICA observatory, and will feature a spectral range from 35 - 210 microns and a spectral resolving power of R=1,000 to 6,000, depending on wavelength. WISPIR provides a choice of full-field spectral imaging over a 2'x2' field or long-slit spectral imaging along a 2' slit for studies of astrophysical structures in the local and high-redshift Universe. WISPIR in long-slit mode will attain a sensitivity two orders of magnitude better than what is currently available.
Author
Imaging Spectrometers; Imaging Techniques; Infrared Imagery; Infrared Radiation; Cosmology; Fourier Transformation; Galaxies; Spectrographs

20100019324 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The GEMS X-Ray Polarlimeter: Instrument Concpet and Calibration Requirements
Jahoda, Keith; April 12, 2010; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The instrument and detector concepts for the Gravity and Extreme Magnetism Small Explorer (GEMS) X-ray polarimetry mission will be presented. The calibration requirements for astrophysical X-ray polarimeters in general and GEMS in particular will be discussed.
Author
Polarimeters; Magnetic Properties; Calibrating; Astrophysics; Polarimetry

20100019458 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hard X-Ray Footprint Source Sized
Dennis, Brian R.; Kontar, E. P.; May 23, 2010; 1 pp.; In English; 216th American Astronomical Society, 23-27 May 2010, Miami, FL, USA; Copyright; Avail.: Other Sources

RHESSI has detected compact hard (25 - 100 keV) X-ray sources that are <4 arcseconds (FWHM) in extent for certain flares (Dennis and Pernak (2009). These sources are believed to be at magnetic loop footpoints that are known from observations at other wavelengths to be very small. Flare ribbons seen in the W with TRACE, for example, are approx. 1 arcsecond in width, and white light flares show structure at the approx. 1 arcsecond level. However, Kontar and Jeffrey (2010) have shown that the measured extent should be >6 arcseconds, even if the X-ray emitting thick-target source is point-like. This is because of the strong albedo contribution in the measured energy range for a source located at the expected altitude of 1 Mm near the top of the chromosphere. This discrepancy between observations and model predictions may indicate that the source altitude is significantly lower than assumed or that the RHESSI image reconstruction procedures are not sensitive to the more diffuse albedo patch in the presence of a strong compact source. Results will be presented exploring the latter possibility using the Pixon image reconstruction procedure and other methods based on visibilities.
Author
X Ray Sources; Image Reconstruction; Chromosphere; Footprints

20100019561 NASA Goddard Space Flight Center, Greenbelt, MD, USA

5,120 Superconducting Bolometers for the PIPER Balloon-Borne CMB Polarization Experiment

Benford, Dominic J.; Chuss, David T.; Hilton, Gene C.; Irwin, Kent D.; Jethava, Nikhil; Jhabvala, Christine A.; Kogut, Alan J.; Miller, Timothy M.; Moseley, S. Harvey; Rostem, Karwan; Sharp, Elmer H.; Staguhn, Johannes G.; Voellmer, George M.; Wollack, Edward J.; [2010]; 4 pp.; In English; SPIE Astronomical Instrumentation: Observational Frontiers of Astonomy for the New Decade, 27 Jun. - 02 Jul. 2010, San Diego, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

We are constructing the Primordial Inflation Polarization Explorer (PIPER) to measure the polarization of the cosmic microwave background (CMB) and search for the imprint of gravity waves produced during an inflationary epoch in the early universe. The signal is faint and lies behind confusing foregrounds, both astrophysical and cosmological, and so many detectors are required to complete the measurement in a limited time. We will use four of our matured 1,280 pixel, high-filling-factor backshort-under-grid bolometer arrays for efficient operation at the PIPER CMB wavelengths. All four arrays observe at a common wavelength set by passband filters in the optical path. PIPER will fly four times to observe at wavelengths of 1500, 1100, 850, and 500 microns in order to separate CMB from foreground emission. The arrays employ leg-isolated superconducting transition edge sensor bolometers operated at 145 mK; tuned resonant backshorts for efficient optical coupling; and a second-generation superconducting quantum interference device multiplexer readout. We describe the design, development, and performance of PIPER bolometer array technology to achieve background-limited sensitivity for a cryogenic balloon-borne telescope.

Author

Balloon-Borne Instruments; Cosmic Microwave Background Radiation; Superconductivity; Polarization (Waves); Bolometers

20100019562 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Bulk Comptonization Model for the Prompt GRB Emission and its Relation to the Fermi GRB Spectra

Kazanas, Demosthenes; April 16, 2010; 2 pp.; In English; GRB 2010: Deciphering the Ancient Universe with Gamma-Ray Bursts, 16-24 Apr. 2010, Kyoto, Japan, Japan; No Copyright; Avail.: Other Sources; Abstract Only

We present a model in which the GRB prompt emission at E ~ E(sub peak) is due to bulk Comptonization by the relativistic blast wave motion of either its own synchrotron photons of ambient photons of the stellar configuration that gave birth to the GRB. The bulk Comptonization process then induces the production of relativistic electrons of Lorentz factor equal to that of the blast wave through interactions with its ambient protons. The inverse compton emission of these electrons produces a power law component that extends to multi GeV energies in good agreement with the LAT GRB observations.

Author

Compton Effect; Gamma Ray Bursts; Synchrotrons; Fermi Gamma-Ray Space Telescope

20100019685 Waterloo Univ., Ontario Canada

Stellar Astrophysics With a Dispersed Fourier Transform Spectrograph. I. Instrument Description and Orbits of Single-Lined Spectroscopic Binaries

Behr, Bradford B; Hajian, Arsen R; Cenko, Andrew T; Murison, Marc; McMillan, Robert S; Hindsley, Robert; Meade, Jeff; Nov 1, 2009; 12 pp.; In English

Report No.(s): AD-A518973; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA518973

We have designed and constructed a second-generation version of the dispersed Fourier transform spectrograph, or dFTS. This instrument combines a spectral interferometer with a dispersive spectrograph to provide highaccuracy, high-resolution optical spectra of stellar targets. The new version, dFTS2, is based upon the design of our prototype, with several modifications to improve the system throughput and performance. We deployed dFTS2 to the Steward Observatory 2.3 m Bok Telescope from 2007 June to 2008 June, and undertook an observing program on spectroscopic binary stars, with the goal of constraining the velocity amplitude K of the binary orbits with 0.1% accuracy, a significant improvement over most of the orbits reported in the literature. We present results for radial velocity reference stars and orbit solutions for single-lined spectroscopic binaries.

DTIC

Accuracy; Astrophysics; Binary Stars; Fourier Transformation; Radial Velocity; Spectrographs; Spectroscopy; Stars

20100020020 Naval Research Lab., Washington, DC USA

New Dimensions in Radiation Effects

Weaver, B D; Jan 2005; 3 pp.; In English

Report No.(s): AD-A519693; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For satellites to be useful in space applications, they must survive the harsh radiation environment of Earth's van Allen

belts. Onboard components are continuously bombarded by high energy protons, electrons, ions, and cosmic rays, which degrade device performance and ultimately cause system failures. Thus in maximizing a satellite's operating lifetime, it is important to know how various devices will respond to radiation damage, and to incorporate radiation-tolerant components into the design.
DTIC
Artificial Satellites; Radiation Belts; Radiation Damage; Radiation Effects; Radiation Tolerance

20100020179 Maryland Univ., College Park, MD, USA
New Results on High Energy Cosmic Ray Electrons Observed with Fermi LAT and Their Implications on the Models of Pulsars
Moiseev, Alexander; April 16, 2010; 22 pp.; In English; ICREA Workshop on the High-Energy Emission from Pulsars and their Systems, 12-16 Apr. 2010, Sant Cugat, Catalonia, Spain; Original contains color illustrations
Contract(s)/Grant(s): NNG06E090A; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100020179
This viewgraph presentation describes, in detail, the Fermi Large Area Telescope (LAT) and GLAST Burst Monitor (GBM). Observations made from the June 11, 2008 launch and a discussion of observations made of high energy cosmic ray electrons is also presented.
CASI
Cosmic Rays; High Energy Electrons; Pulsars; Fermi Gamma-Ray Space Telescope; Astrophysics

20100020258 Air Force Research Lab., Hanscom AFB, MA USA
Circumstellar Structure Around Evolved Stars in the Cygnus-X Star Formation Region
Kraemer, Kathlen E.; Hora, Joseph L.; Egan, Michael P.; Adams, Joseph; Allen, Lori E.; Bontemps, Sylvain; Carey, Sean J.; Fazio, Giovanni G.; Gutermuth, Robert; Keto, Eric; The Astronomical Journal; June 2010; Volume 139, No. 6, pp. 2319-2329; In English; Original contains color illustrations
Contract(s)/Grant(s): 62601F
Report No.(s): AD-A518933; AFRL-RV-HA-TR-2010-1032; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA518933
We present observations of newly discovered 24 micron circumstellar structures detected with MIPS around three evolved stars in the Cygnus-X star-forming region. One of the objects, BD+43 3710, has a bipolar nebula, possibly due to an outflow or a torus of material. A second, HBHA 4202-22, a Wolf-Rayet candidate, shows a circular shell of 24 micron emission suggestive of either a limb-brightened shell or disk seen face-on. No diffuse emission was detected around either of these two objects in the Spitzer 3.6-8 micron IRAC bands. The third object is the luminous blue variable candidate G79.29+0.46. We resolved the previously known inner ring in all four IRAC bands. The 24 micron emission from the inner ring extends 1 deg.2 beyond the shorter wavelength emission, well beyond what can be attributed to the difference in resolutions between MIPS and IRAC. Additionally, we have discovered an outer ring of 24 micron emission, possibly due to an earlier episode of mass loss. For the two shell stars, we present the results of radiative transfer models, constraining the stellar and dust shell parameters. The shells are composed of amorphous carbon grains, plus polycyclic aromatic hydrocarbons in the case of G79.29+0.46. Both G79.29+0.46 and HBHA 4202-22 lie behind the main Cygnus-X cloud. Although G79.29+0.46 simply may be on the far side of the cloud, HBHA 4202-22 is unrelated to the Cygnus-X star formation region.
DTIC
Star Formation; Stellar Envelopes

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20100018417 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Phoenix Mars Mission
Tamppari, Leslie K.; Smith, Peter H.; January 29, 2008; 20 pp.; In English; Polar Gateways Conference, 29 Jan. 2008, Barrow, AK, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41533
This slide presentation details the Phoenix Mission which was designed to enhance our understanding of water and the

potential for habitability on the north polar regions of Mars. The slides show the instruments and the robotics designed to scrape Martian surface material, and analyze it in hopes of identifying water in the form of ice, and other chemicals.
CASI
Mars Missions; Mars Surface; Phoenix Mars Lander; Extraterrestrial Water

20100018422 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Europa Geophysical Explorer Mission Concept Studies
Green, Jacklyn R.; Abelson, R.; Smythe, W.; Spilker, T.; Shirley, J.; December 9, 2005; 14 pp.; In English; American Geophysical Union Meeting, 9 Dec. 2005, San Francisco, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41566

This slide presentation discusses the studies done to outline the concept of a explorer mission to the Jovian Moon, Europa, that would allow a further understanding of the Geophysics of that moon. Included in the presentation are an outline of the possible trajectory, including flyby assists, a listing of the science objectives and the scientific instruments that would be used in the completion of the objectives.
CASI
Europa; Mission Planning; Outer Planets Explorers

20100020172 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Nation's Vision for Exploration: An Update
Sander, Michael J.; August 20, 2007; 28 pp.; In English; Commonwealth Scientific and Industrial Research Organization (CSIRO) Workshop, 20-22 Aug. 2010, Melbourne, Australia; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41561

I.Current key activities: a) Constellation Level2-System Engineering. b) Lunar Architecture Team (LAT)2-technology assessment and architectural option for the lander. c) Mars Architecture Team-system engineering support, Science integration, precursor program planning. d) Lunar Lander Project Core Team-GN&C and Flight system engineering. e) Technology program-supporting multiple projects in robotics, power systems, aero entry technology. f) Mission Operation Project-Mission operations system engineering. g) Advanced Environmental Monitoring Instruments. H. Lunar Reconnaissance Orbiter instrument (Diviner). II. Mission Proposals a) Lunar Sample return. b) Lunar Gravity field mapper.
Author
Aeronautical Engineering; Environmental Monitoring; Systems Engineering; Sample Return Missions; Project Planning; Lunar Geology; Lunar Orbiter; Lunar Rocks; Gravitational Fields

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20100019247 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Flare Comparisons of the Flare Irradiance Spectral Model (FISM) to Preliminary SDO EVE Data
Chamberlon, Phillip C.; May 23, 2010; 1 pp.; In English; 216th American Astronomical Society Meeting (AAS), 23-27 May 2010, Miami, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Solar Dynamics Observatory (SDO) launched February 11, 2010 from Kennedy Space Center and started normal science operations in April 2010. One of the instruments onboard SDO, the EUV Variability- Experiment (EVE), will measure the solar EUV irradiance from 0.1-105 nm with 0.1 nm spectral resolution as well as a measure of the broad-band Lyman-Alpha emission (121.0 rim), all with less than 10 percent uncertainties. One of the biggest improvements of EVE over its predecessors is its ability to continuously measure the complete spectrum ever y 10 seconds, 24 hours a day, 7 days a week. This temporal coverage and cadence will greatly enhance the knowledge of the solar EUV variations during solar flares. This paper will present a comparison of the Flare Irradiance Spectral Model (FISM), which can produce an estimated EUV

spectrum at 10 seconds temporal resolution, to the preliminary flare observation results from SDO EVE. The discussion will focus on the short-term EUV flare variations and evolution.
Author
Solar Observatories; Extreme Ultraviolet Radiation; Solar Radiation; Lyman Alpha Radiation; Spectral Resolution; Temporal Resolution; Irradiance; Helioseismology

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20100018421 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Radiation Transport Tools for Space Applications: A Review
Jun, Insoo; Evans, Robin; Cherng, Michael; Kang, Shawn; February 16, 2008; 40 pp.; In English; 5th Geant4 Space Users' Workshop, 16 Feb. 2008, Tokyo, Japan; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41523
This slide presentation contains a brief discussion of nuclear transport codes widely used in the space radiation community for shielding and scientific analyses. Seven radiation transport codes that are addressed. The two general methods (i.e., Monte Carlo Method, and the Deterministic Method) are briefly reviewed.
CASI
Extraterrestrial Radiation; Radiation Transport; Radiation; Simulation

20100018522 Pacific Northwest National Lab., Richland, WA, USA
Radiation Protection Instrument Manual. Revision 1. PNL-MA-562
Johnson, M. L.; September 23, 2009; 328 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2009-967003; PNNL-14135 REV-1; No Copyright; Avail.: Department of Energy Information Bridge
This manual provides specific information for operating and using portable radiological monitoring instruments available for use on the Hanford Site.
NTIS
Radiation Protection; Radiology

20100018593 NASA Johnson Space Center, Houston, TX, USA
Overview of the Graphical User Interface for the GERM Code (GCR Event-Based Risk Model
Kim, Myung-Hee; Cucinotta, Francis A.; May 16, 2010; 1 pp.; In English; 21st Annual NASA Space Radiation Investigators' Workshop, 16-19 May 2010, Port Jefferson, NY, USA; Original contains color illustrations
Report No.(s): JSC-CN-20682; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100018593
The descriptions of biophysical events from heavy ions are of interest in radiobiology, cancer therapy, and space exploration. The biophysical description of the passage of heavy ions in tissue and shielding materials is best described by a stochastic approach that includes both ion track structure and nuclear interactions. A new computer model called the GCR Event-based Risk Model (GERM) code was developed for the description of biophysical events from heavy ion beams at the NASA Space Radiation Laboratory (NSRL). The GERM code calculates basic physical and biophysical quantities of high-energy protons and heavy ions that have been studied at NSRL for the purpose of simulating space radiobiological effects. For mono-energetic beams, the code evaluates the linear-energy transfer (LET), range (R), and absorption in tissue equivalent material for a given Charge (Z), Mass Number (A) and kinetic energy (E) of an ion. In addition, a set of biophysical properties are evaluated such as the Poisson distribution of ion or delta-ray hits for a specified cellular area, cell survival curves, and mutation and tumor probabilities. The GERM code also calculates the radiation transport of the beam line for either a fixed number of user-specified depths or at multiple positions along the Bragg curve of the particle. The contributions from primary ion and nuclear secondaries are evaluated. The GERM code accounts for the major nuclear interaction processes of importance for describing heavy ion beams, including nuclear fragmentation, elastic scattering, and knockout-cascade processes by using the quantum multiple scattering fragmentation (QMSFRG) model. The QMSFRG model has been shown

to be in excellent agreement with available experimental data for nuclear fragmentation cross sections, and has been used by the GERM code for application to thick target experiments. The GERM code provides scientists participating in NSRL experiments with the data needed for the interpretation of their experiments, including the ability to model the beam line, the shielding of samples and sample holders, and the estimates of basic physical and biological outputs of the designed experiments. We present an overview of the GERM code GUI, as well as providing training applications.
Author
Biophysics; Graphical User Interface; Linear Energy Transfer (LET); Risk; Heavy Ions; Cancer; Radiobiology; Tumors; Radiation Transport

20100019249 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Reconstructing the Solar VUV Irradiance over the Past 60 Years
Chamberlin, Phillip; [2010]; 1 pp.; In English; Global Change and Solar-Terrestrial Environment Workshop, 12-17 Jun. 2010, Aspen, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Flare Irradiance Spectral Model (FISM) is an empirical model of the solar irradiance spectrum from 0.1 to 190 nm at I nm spectral resolution and on a 1-minute time cadence. The goal of FISM is to provide accurate solar spectral irradiances over the vacuum ultraviolet (VUV: 0-200 nm) range as input for ionospheric and thermospheric models, as well as climate studies over 60 years. A brief overview of the FISM model will be given, and also discussed is how the Solar Dynamics Observatory (SDO) EUV Variability Experiment (EVE) will contribute to improving FISM and its accuracies. Results will also be shown quantifying the VUV contributions to the total flare energy budget, and more importantly discuss the increased errors associated by not including flares in the solar energy input to the Earth's system. Concluding the talk will be a discussion of the proxies, and their associated uncertainties, used for solar spectral reconstructions prior to 1947 going back hundreds of years.
Author
Irradiance; Atmospheric Models; Extreme Ultraviolet Radiation; Solar Energy; Spectral Resolution; Spectral Theory; Light (Visible Radiation); Solar Radiation; Earth Ionosphere

20100019268 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Initial Results of Aperture Area Comparisons for Exo-Atmospheric Total Solar Irradiance Measurements
Johnson, B. Carol; Litorja, Maritoni; Fowler, Joel B.; Butler, James J.; August 23, 2009; 1 pp.; In English; CALCON Technical Conference, 23-28 Aug. 2009, Logan, UT, USA; Copyright; Avail.: Other Sources; Abstract Only

In the measurement of exo-atmospheric total solar irradiance (TSI), instrument aperture area is a critical component in converting solar radiant flux to irradiance. In a May 2000 calibration workshop for the Total Irradiance Monitor (TIM) on the Earth Observing System (EOS) Solar Radiation and Climate Experiment (SORCE), the solar irradiance measurement community recommended that NASA and NISI coordinate an aperture area measurement comparison to quantify and validate aperture area uncertainties and their overall effect on TSI uncertainties. From May 2003 to February 2006, apertures from 4 institutions with links to the historical TSI database were measured by NIST and the results were compared to the aperture area determined by each institution. The initial results of these comparisons are presented and preliminary assessments of the participants' uncertainties are discussed.
Author
Earth Observing System (EOS); Solar Radiation; Irradiance; Climate; Solar Flux

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