



**National Aeronautics and
Space Administration
Langley Research Center**

**Scientific and Technical
Information Program Office**

Scientific and Technical Aerospace Reports

STAIR

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NASA STI Program ... in Profile

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- **TECHNICAL MEMORANDUM.** Scientific and technical findings that are preliminary or of specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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- **TECHNICAL TRANSLATION.** English-language translations of foreign scientific and technical material pertinent to NASA's mission.

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Hanover, MD 21076-1320

Introduction

Scientific and Technical Aerospace Reports (STAR) is an online information resource listing citations and abstracts of NASA and worldwide aerospace-related scientific and technical information (STI). Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related research and development (R&D) results.

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.

STAR includes citations to R&D results reported in:

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

The NASA STI Program

The NASA STI Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

Through the NASA Center for AeroSpace Information (CASI), the NASA STI Program acquires, processes, archives, announces, and disseminates both NASA's internal STI and worldwide STI. The results of 20th and 21st century aeronautics and aerospace research and development, a worldwide investment totaling billions of dollars, have been captured, organized, and stored in the NASA Aeronautics and Space Database. New information is continually announced and made available as it is acquired, making this a dynamic and historical collection of value to business, industry, academia, federal institutions, and the general public.

The STI Program offers products and tools that allow efficient access to the wealth of information derived from global R&D efforts. In addition, customized services are available to help tailor this valuable resource to meet your specific needs.

For more information on the most up-to-date NASA STI, visit the STI Program's Web site at <http://www.sti.nasa.gov>.

NASA STI Availability Information

NASA Center for AeroSpace Information (CASI)

Through NASA CASI, the NASA STI Program offers many information products and services to the aerospace community and to the public, including access to a selection of full text of the NASA STI. Free registration with the program is available to NASA, U.S. Government agencies and contractors. To register, contact CASI at help@sti.nasa.gov. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (NTRS) – the publicly available contents of the NASA Aeronautics and Space Database.

Each citation in *STAR* indicates a 'Source of Availability.' When CASI is indicated, the user can order this information directly from CASI using the [STI Online Order Form](#), e-mail to help@sti.nasa.gov, or telephone the STI Help Desk at 301-621-0390. Before ordering you may access [price code tables](#) for STI documents and videos. When information is not available from CASI, the source of the information is indicated when known.

NASA STI is also available to the public through Federal information organizations. NASA CASI disseminates publicly available NASA STI to the National Technical Information Service (NTIS) and to the Federal Depository Library Program (FDLP) through the Government Printing Office (GPO). In addition, NASA patents are available online from the U.S. Patent and Trademark Office.

National Technical Information Service (NTIS)

The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at <http://www.ntis.gov>.

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The U.S. Congress established the **Federal Depository Library Program** to ensure access for the American public to U.S. Government information. The program acquires and disseminates information products from all three branches of the U.S. Government to nearly 1,300 Federal depository libraries nationwide. The libraries maintain these information products as part of their existing collections and are responsible for assuring that the public has free access to the information. Locate the Federal depository libraries at <http://www.gpoaccess.gov/index.html>.

The U.S. Patent and Trademark Office (USPTO)

The U.S. Patent and Trademark Office provides online access to full text patents and patent applications. The database includes patents back to 1976 plus some pre-1975 patents. Visit the USPTO at <http://www.uspto.gov/patft/>.

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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.

20080005207 NASA Glenn Research Center, Cleveland, OH, USA

Rapid Calculations of Three-Dimensional Inlet/Fan Interaction

Chima, Rodrick V.; October 30, 2007; 27 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005207>

Two computational fluid dynamics codes have been merged to permit rapid calculations of inlet/fan interaction. Inlets are modeled using the WIND-US Navier-Stokes code. Fans are modeled using a new three-dimensional Euler code called CSTALL that solves the flow through the entire compression system but models blade rows using body forces for turning and loss. The body force model is described and it is shown how unknown terms in the model can be estimated from other Navier-Stokes solutions of the blade rows run separately. The inlet and fan calculations are run simultaneously and are coupled at an interface plane using a third code called SYNCEX that is described briefly. Results are shown for an axisymmetric nacelle at high angle of attack modeled both as an isolated inlet and coupled to a single stage fan. The isolated inlet calculations are unrealistic after the flow separates but the coupled codes can model large regions of separated flow extending from the lower lip of the nacelle into the fan rotor.

Author

Computational Fluid Dynamics; Nacelles; Separated Flow; Navier-Stokes Equation; Euler Equations of Motion; Angle of Attack

20080005556 NASA Glenn Research Center, Cleveland, OH, USA

Aerothermodynamics Overview and Prediction Assessment

Heidmann, James D.; October 31, 2007; 31 pp.; In English; NASA Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.21.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005556>

An overview of the Aerothermodynamics Discipline within NASA's Subsonic Fixed Wing Project is given. The primary focus of the presentation is on the research efforts conducted in fiscal year 2007. This year (2007), the work primarily consisted of efforts under level 1 (foundational research) and level 2 (tools and technology development). Examples of work under level 1 are large eddy simulation development, advanced turbine cooling concept development, and turbomachinery flow control development. Examples of level 2 research are the development of highly-loaded compressor and turbine test programs and advanced turbomachinery simulation development, including coupled inlet-fan simulations. An overview of the NRA research activity is also provided. This NRA focused on plasma and aspiration flow control for low pressure turbine application. Finally, a status report on the turbomachinery CFD code assessment activity is provided. This activity focuses on the use of several NASA in-house codes for the NASA rotor 37 and stage 35 test cases.

Author

Aerothermodynamics; Computational Fluid Dynamics; Magnetohydrodynamic Flow; Turbomachinery; Large Eddy Simulation; Fixed Wings

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.

20080003007 Army Research Lab., Aberdeen Proving Ground, MD USA

Coupled CFD/GN&C Modeling for a Smart Material Canard Actuator

Weinacht, Paul; Sep 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474071; ARL-TR-4265; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474071>

The performance of a smart material canard actuator has been investigated using coupled computational fluid dynamics, guidance navigation and control, and structural models. The predictions show that the open-loop response of the smart material actuator does not produce the commanded deflection due to the interaction of the externally applied aerodynamic hinge moment with the flexible actuator structure. A closed-loop feedback control law with integral control is applied in order for the canard to attain the commanded deflection. However, the predictions show that the gain for the integral controller must be correctly selected to obtain the proper response of the canard. The selected gain is dependent on both the structural characteristics of the actuator and the applied aerodynamics.

DTIC

Actuators; Aerodynamics; Canard Configurations; Computational Fluid Dynamics; Smart Materials

20080003152 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Comparative Study of Aerodynamic Interference During AFT Dispense of Munitions

Burkinshaw, Matthew G; Sep 2007; 173 pp.; In English

Report No.(s): AD-A474351; AFIT/GAE/ENY/07-J03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Based on forthcoming USAF needs, an investigation was launched to further the understanding of aft dispense of munitions in a high-speed environment. A computational fluid dynamics (CFD) study was performed followed by a wind tunnel experiment. The study consisted of a strut-mounted cone simulating a parent vehicle and a sting mounted cone-cylinder store situated directly behind the cone. The CFD modeled the test objects inside a supersonic wind tunnel in which the experiments took place. The CFD study consisted of evaluating a new strut designed to reduce asymmetry in the airflow aft of the cone. The CFD study also included predictions of axial loads acting on the store in various locations behind the cone. The experimental study consisted of implementing the new strut and introducing a miniature load cell for comparison to CFD load predictions. The CFD study indicated the newly designed strut lengthened the cone's base region by 27% and reduced transverse forces acting on the store by as much as 50% in two of the three locations evaluated. The experimental studies were successful in obtaining axial force coefficients that matched the CFD trend and were typically within 30% of the magnitudes. It was concluded that the load cell was generally adequate in measuring the axial loading on the store though its accuracy is less than that of a typical wind tunnel balance. The error trends indicate that the polymer store introduces the least amount of statistical error making it the most accurate representation of the results. Significant sources of error include transverse vibrations and axial buffeting observed in the wind tunnel tests.

DTIC

Aerodynamic Interference; Aerodynamics; Air Flow; Ammunition; Computational Fluid Dynamics; Loads (Forces); Measuring Instruments; Supersonic Wind Tunnels

20080003867 NASA Glenn Research Center, Cleveland, OH, USA

Comparison of Far-Field Noise for Three Significantly Different Model Turbofans

Woodward, Richard P.; January 07, 2008; 14 pp.; In English; 46th AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003867>

Far-field noise sound power level (PWL) spectra and overall sound pressure level (OASPL) directivities were compared for three significantly different model fan stages which were tested in the NASA Glenn 9x15 Low Speed Wind Tunnel. The test fans included the Advanced Ducted Propulsor (ADP) Fan1, the baseline Source Diagnostic Test (SDT) fan, and the Quiet High Speed Fan2 (QHSF2) These fans had design rotor tangential tip speeds from 840 to 1474 ft/s and stage pressure ratios

from 1.29 to 1.82. Additional parameters included rotor-stator spacing, stator sweep, and downstream support struts. Acoustic comparison points were selected on the basis of stage thrust. Acoustic results for the low tip speed/low pressure ratio fan (ADP Fan1) were thrust-adjusted to show how a geometrically-scaled version of this fan might compare at the higher design thrust levels of the other two fans. Lowest noise levels were typically observed for ADP Fan1 (which had a radial stator) and for the intermediate tip speed fan (Source Diagnostics Test, SDT, R4 rotor) with a swept stator. Projected noise levels for the ADP fan to the SDT swept stator configuration at design point conditions showed the fans to have similar noise levels. However, it is possible that the ADP fan could be 2 to 3 dB quieter with incorporation of a swept stator. Benefits of a scaled ADP fan include avoidance of multiple pure tones associated with transonic and higher blade tip speeds. Penalties of a larger size ADP fan would include increased nacelle size and drag.

Author

Far Fields; Turbofans; Aerodynamic Noise; Turbofan Engines; Jet Aircraft Noise; Noise (Sound)

20080005528 NASA Glenn Research Center, Cleveland, OH, USA

RANS Analyses of Turbofan Nozzles with Wedge Deflectors for Noise Reduction

DeBonis, James R.; January 07, 2008; 31 pp.; In English; 46th AIAA Aerospace Sciences Meeting, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005528>

Computational fluid dynamics (CFD) was used to evaluate a promising concept for reducing the noise at take-off of dual-stream, turbofan nozzles. The concept, offset stream technology, reduces the jet noise observed on the ground by diverting (offsetting) the majority of the fan flow below the core flow, thickening this layer between the high velocity core flow and the ground observers. In this study a wedge placed in the internal fan stream is used as the diverter. Wind, a Reynolds Averaged Navier-Stokes (RANS) code, was used to analyze the flowfield of the exhaust plume and to calculate nozzle performance. Results showed that the wedge effectively diverts the fan flow and the turbulent kinetic energy on the observer side of the nozzle is reduced. The reduction in turbulent kinetic energy should correspond to a reduction in noise. The blockage due to the wedge reduces the fan massflow proportional to its blockage and the overall thrust is consequently reduced. The CFD predictions are in very good agreement with experimental data. This noise reduction concept shows promise for reduced jet noise at a small reduction in thrust. It has been demonstrated that RANS CFD can be used to optimize this concept.

Author

Computational Fluid Dynamics; Deflectors; Jet Aircraft Noise; Navier-Stokes Equation; Noise Reduction; Reynolds Averaging; Turbofans; Wedges

20080005551 NASA Glenn Research Center, Cleveland, OH, USA

NASA/GE Highly-Loaded Turbine Research Program

Giel, Paul W.; October 31, 2007; 19 pp.; In English; NASA Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 561581.02.08.03.21.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005551>

An overview of the NASA/GE Highly-Loaded Turbine Research Program at the NASA Glenn Research Center is presented. The program is sponsored by the Subsonic Fixed Wing Project of the Fundamental Aeronautics Program. The goals of the turbine research program are presented along with their relationship to the higher-level program goals. Two turbine research programs are described; the highly-loaded, single-stage high pressure turbine (HPT) and the highly loaded low pressure turbine (LPT). The HPT program is centered on an extremely high pressure ratio single-stage turbine with an engine stage pressure ratio of 5.5. It was designed with a 33% increase in stage loading. It has shown performance levels 2 points better than current engines operating at the higher work level. Some advantages of the turbine include reduced weight and parts count. Optimization of the blade shape to reduce shock losses is described. The LPT program utilizes a four-stage low pressure turbine with an integral first stage vane/transition duct strut; counter-rotation; low-solidity blading; fully optimized flowpath including vanes, blades, and endwalls; and a fluidically controlled turbine vane frame/exit guide vane. The implementation of the LPT into GE's and NASA's test facilities is described. A description of NASA's Single Spool Turbine Facility that is currently under renovation is given. Facility limits on pressures, temperatures, flow rates, rotational speeds, and power absorption are described. The current renovation status is given.

Author

High Pressure; Low Pressure; Turbines; NASA Programs; Jet Propulsion

20080005672 Australian National Univ., Canberra, Australia

The Temporal Resolution of Flight Attitude Control in Dragonflies and Locusts: Lessons for the Design of Flapping-Wing MAVs

Stange, Gert; Schmeling, Fabian; Berry, Richard; Lenz, Gerlinde; Dec 4, 2007; 16 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0059

Report No.(s): AD-A474830; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In order to identify stability constraints in flapping-winged MAVs, within the context of longitudinal stabilization of flight attitude, the question is examined whether insects are capable of controlling flight attitude at the temporal resolution of a single wing beat. It is found that the phenomenon of phase locking between a periodic light flash and the wingbeat of insects is suitable for the examination of the time resolution with which vision contributes to stabilization. In tethered locusts, flying in a wind tunnel with a wingbeat frequency of 22 Hz, phase locking can be readily obtained by a periodic stimulus of UV light. It is suggested that the effect is a by-product of the animal continuously trying to apply corrections. Therefore, in the closed-loop situation of free flight, frequency components of the visual input at or above wing beat rate are also present and must contribute to stability control. The response is mediated by the median ocellus. In dragonflies, with a wingbeat frequency of 50 Hz, the effect is not observed. This suggests that organisms or MAV of the size and wingbeat rate of locusts require active damping by visual inputs, whereas the same is not necessary in smaller systems.

DTIC

Aerodynamic Stability; Attitude Control; Flapping; Flight Control; Insects; Oscillations; Temporal Resolution; Wings

20080005810 Air Force Research Lab., Eglin AFB, FL USA

Experimental Elastic Deformation Characterization of a Flapping-Wing MAV Using Visual Image Correlation

Stewart, Kelly; Albertani, Roberto; Nov 2007; 18 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A474536; AFRL-RW-EG-TP-2007-7418; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This presentation will detail AFRL/RW's collaboration with the University of Florida to derive a method for estimating elastic deformation in flexible, flapping wings. By knowing the elastic deformation that occurs, researchers can better understand the mechanics and aerodynamic effects behind flexible, flapping wings and apply that knowledge to various design aspects of micro air vehicles (MAV's) such as wing structure, guidance and control, etc.

DTIC

Drone Vehicles; Elastic Deformation; Elastic Properties; Flapping; Image Correlators; Wings

20080006102 Stanford Univ., Stanford, CA USA

Magneto-Fluid Dynamics Calculations for Aerodynamics

MacCormack, Robert W; Nov 20, 2007; 35 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0155

Report No.(s): AD-A475000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475000>

Magneto-Hydro-Dynamics (MHD) or more generally Magneto-Fluid-Dynamics (MFD) offers a potential breakthrough in both hypersonic vehicle design and propulsion. Reductions in both drag and heat transfer and flow control using magnetic fields can be important for enabling a hypersonic vehicle to pass more efficiently and safely through the atmosphere. Magnetic and electric fields placed within the propulsion system may enable the extraction of electrical energy from the ionized flow entering the engine, thus slowing the air speed without the usual large losses in total pressure caused by conventional shock wave deceleration and thereby enhancing complete combustion, and then later returning the extracted energy back into the flow after combustion for further acceleration. These potential benefits may or may not be realizable for air vehicle design. Realistic aerodynamic simulations, under the conditions of expected low electrical conductivities and strong magnetic fields, will be required. The solution of the complete equations governing magneto-fluid dynamics, including magnetic induction and diffusion, within strong magnetic fields can introduce severe numerical simulation difficulties. The goal of this research is to develop algorithms for their solution.

DTIC

Aerodynamics; Algorithms; Fluid Dynamics; Gas Flow; Hypersonic Vehicles; Ionized Gases; Magnetohydrodynamics; Mathematical Models

20080006489 NASA Langley Research Center, Hampton, VA, USA

Reynolds-Averaged Navier-Stokes Analysis of Zero Efflux Flow Control over a Hump Model

Rumsey, Christopher L.; [2006]; 34 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006489>

The unsteady flow over a hump model with zero efflux oscillatory flow control is modeled computationally using the unsteady Reynolds-averaged Navier-Stokes equations. Three different turbulence models produce similar results, and do a reasonably good job predicting the general character of the unsteady surface pressure coefficients during the forced cycle. However, the turbulent shear stresses are underpredicted in magnitude inside the separation bubble, and the computed results predict too large a (mean) separation bubble compared with experiment. These missed predictions are consistent with earlier steady-state results using no-flow-control and steady suction, from a 2004 CFD validation workshop for synthetic jets.

Author

Unsteady Flow; Turbulence Models; Computational Fluid Dynamics; Navier-Stokes Equation; Reynolds Averaging; Shear Stress; Pressure Ratio; Oscillations; Efflux

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.

20080002933 Naval Postgraduate School, Monterey, CA USA

Enhancement of the Daytime MODIS Based Icing Potential Using NOGAPS and COAMPS Model Data

Davidson, Richard L; Sep 2007; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473914; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473914>

In this thesis, NOGAPS and COAMPS model data are fused with Alexander (2005) algorithm to determine its usefulness in enhancing satellite-based aircraft icing analysis. This is a follow on to Cooper (2006) research where MM5 and ETA were used. Using historical NOGAPS and COAMPS data (T, Td and RH) accessed from the GODAE server, several storms from 2004 were fused with available MODIS imagery from the same storms to produce an enhanced icing product. Pilot reports (PIREPS) were used as a validation tool to determine where icing was taking place during the storms analyzed. A comparison was made between the MODIS-based icing potential and the model-based icing potential. The two icing potentials were fused together to produce an enhanced icing product. Statistical analysis using ROC curves was performed on the various combinations to determine which product combination gave the best results. Two different available Tmap (Alexander and CIP) were used and had mixed results. Contrary to what Cooper (2006) found where weighting RH and the Alexander Tmap produced the best results; this study found that equal weighting of T and RH and the CIP Tmap produced the same or better results than weighting RH. This study also found that NOGAPS combined with the MODIS algorithm provide the best icing potential results.

DTIC

Augmentation; Daytime; Ice Formation; Imaging Spectrometers; MODIS (Radiometry); Satellite Imagery; Weather Forecasting

20080002957 California Univ., Berkeley, CA USA

Flight Simulation of a 3 gram Autonomous Glider

Entwistle, Jon P; May 24, 2006; 61 pp.; In English

Contract(s)/Grant(s): FA8650-05-C-7138; IIS-0412541

Report No.(s): AD-A473961; UCB-EECS-2006-80; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473961>

The Microglider project at UC Berkeley aims at designing an autonomous, palmsized glider to serve as a test-bed for minimum sensor flight control. In order to quickly test and refine the flight control strategies of the microglider, a software

tool is presented here which simulates the microglider in flight. The simulated glider is tested using ocelli and optical flow sensors, and a discrete motion control strategy is designed and refined.

DTIC

Autonomy; Flight Simulation; Gliders

20080003009 Texas A&M Univ., College Station, TX USA

Experimental Analysis of the Vorticity and Turbulent Flow Dynamics of a Pitching Airfoil at Realistic Flight Conditions

Bowersox, Rodney D; Sahoo, Dipankar; Aug 31, 2007; 153 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0045

Report No.(s): AD-A474073; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474073>

The primary objective of this research proposal was improved understanding of the fundamental vorticity and turbulent flow physics for a dynamically stalling airfoil at realistic helicopter flight conditions. To meet this objective, an experimental program using high-resolution particle image velocimetry was performed. High-resolution planar contours of the instantaneous and mean velocity field on a dynamically pitching NACA 0012 airfoil operating in the Texas A&M University large-scale wind tunnel are planned. For the present study, the Mach number, chord Reynolds number, and reduced frequency were selected as 0.2/0.3, 2.0/2.8x10⁶ and 0.1/0.18, respectively. The test matrix included static attached, static stall, light dynamic stall and deep dynamic stall. The goal of these analyses was improved understanding of the dynamic stall processes at realistic flight conditions. The velocity data was processed to examine the vorticity and turbulent transport near the leading edge during stall. The data from this study are summarized in this report.

DTIC

Airfoils; Flight Conditions; Fluid Dynamics; Turbulent Flow; Vortices; Vorticity

20080003043 Naval Postgraduate School, Monterey, CA USA

Optimal Aircraft Routing in a Constrained Path-Dependent Environment

Karczewski, III, Norbert J; Sep 2007; 57 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474173>

In this thesis, we present a method of automatically generating a route of flight for an aircraft, or a group of aircraft flying in formation, from an origin to a destination in the presence of threats. The threats encountered at a point of the route are a function of the route used to arrive there. The route is constrained by limits on one or more resources, such as fuel and time, expended over the course of the route. We use a C++ program to implement the method for two scenarios. In the first scenario, we generate optimal routes for a path-dependent radar threat environment. We then compare these results with routes generated for a path-independent radar threat. In a second scenario, we generate a route for a three-dimensional airspace over terrain in the presence of two constraints and multiple threats that vary dependent upon the route taken. The computing time required to generate a route is sufficiently short for use of the method in mission planning tools. Recommendations for future research and model improvement conclude the thesis.

DTIC

Flight Paths; Radar

20080003140 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Raman Scattering Study of Supercritical Bi-Component Mixtures Injected into a Subcritical Environment

An, Young M; Sep 2007; 154 pp.; In English

Report No.(s): AD-A474331; AFIT/GA/ENY/07-S01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research studies the species distribution profiles of methane/ethylene bi-components at downstream locations filled with subcritical nitrogen in a closed chamber. Unique thermodynamic and transport properties of supercritical fluids along with phase transition phenomena during fuel injection process can significantly change combustion characteristics inside a scramjet combustor. Plume properties of supercritical jets are of great interests to the studies of fuel/air mixing and subsequent combustion. The primary goal of this research is to help to clarify whether there is any preferential condensation within the condensed jets. The Raman Scattering technique is used to quantify spatial distribution of injected methane and ethylene. Each species distribution profile is developed in terms of mole fraction. Results demonstrated there is ethylene preferential

condensation within the supercritical bi-component mixture of the jet. It also showed the condensation phenomenon is less desirable for combustion. 15.

DTIC

Raman Spectra; Supersonic Combustion Ramjet Engines; Velocity

20080003143 Mitre Corp., McLean, VA USA

Collision Avoidance for Unmanned Aircraft: Proving the Safety Case

Zeitlin, Andrew; Lacher, Andrew; Kuchar, James; Drumm, Ann; Oct 2006; 12 pp.; In English

Contract(s)/Grant(s): DTFA01-01-C-00001; FA8721-05-C-0002

Report No.(s): AD-A474336; MP-060219; LL-42PM-ATC-329; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The MITRE Corporation and Lincoln Laboratory have collaborated on this paper because we believe that it is important to articulate the system safety studies needed. Our two organizations bring a wealth of knowledge and experience associated with the development and implementation of TCAS. We were directly involved and/or closely associated with a significant portion of the system safety analysis that supported RTCA, FAA, Eurocontrol, and International Civil Aviation Organization (ICAO) decisions related to TCAS2 standards and certification. Section 2 of this paper describes the safety analysis process. It gives a high level description of each step in the process, with emphasis on issues unique to UAS. Sections 3 through 5 describe selected areas in more detail. Section 3 addresses sensors and algorithms, which are specific aspects of the Concept of Operations. Section 4 describes encounter model development. Section 5 describes the combination of fault tree analysis and dynamic simulation to assess UAS collision avoidance performance. Section 6 gives a summary.

DTIC

Aircraft; Collision Avoidance; Drone Vehicles; Safety

20080003329 Northrop Grumman Information Technology, Inc., Fairborn, OH USA

AWACS Dialogue Training System (DTS) Evaluation

Haas, Michael W; Salyer, Michael; Hettinger, Lawrence J; Aug 2007; 65 pp.; In English

Contract(s)/Grant(s): FA8650-05-D-6633; Proj-7184

Report No.(s): AD-A473905; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473905>

The objective of this task was to evaluate the features of the AWACS Dialogue Training System. The intent of this system is to reduce the number of personnel resources currently devoted to supporting AWACS WD training. A series of questionnaires were developed to collect information from participants. The results of this evaluation are intended to help inform AETC about the maturity and readiness of the AWACS-Dialogue Training System to support WD training, and provide suggestions for potential improvements.

DTIC

AWACS Aircraft; Distributed Interactive Simulation; Evaluation; System Effectiveness; Systems Analysis; Training Evaluation

20080005226 Naval Postgraduate School, Monterey, CA USA

An Operational Manpower Analysis of the RQ-8 Fire Scout Vertical Take-Off Unmanned Aerial Vehicle (VTUAV)

Stracker, Matthew C; Sep 2007; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474494; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In August of 2001 the Secretary of the Navy announced the Navy would expand the work and experimentation in unmanned vehicle systems. After the events of September 11 this was accelerated with the increased urgency to combat terrorism and asymmetric threats. The U.S. Navy is currently undergoing testing and evaluation of the Fire Scout Vertical Take-Off Unmanned Aerial Vehicle (VTUAV) and its integration into the fleet. An in depth analysis of the Fire Scout's manpower requirements is necessary as part of total force integration. At the present time, the Navy only utilizes aviation ratings by requirement and assignment as unmanned aerial system operators, unlike the Army and Marine Corps. Therefore, the Littoral Combat Ship manpower requirements exceed the Navy's target of 25 persons for the combined RQ-8B and SH-60 air detachment. Analysis shows a possible remedy to this problem is to allow non-aviation ratings the opportunity to operate the Fire Scout. This change in policy and occupational standards would generate greater operational capability and personnel flexibility for this newly acquired air ship and surface platform. Specifically, occupational research showed the Aviation Administrationman (AZ) rating is no more qualified to operate a Fire Scout VTUAV than the Operations Specialist (OS) rating. In fact, it can be argued that an OS is better qualified according to occupational standards to operate the Fire Scout.

Therefore, one of the recommendations of this research is to add Operational Specialist as a source rating to NECs 8363 and 8364 immediately.

DTIC

Drone Vehicles; Fires; Manpower; Pilotless Aircraft; Takeoff

20080005250 Federal Aviation Administration, Oklahoma City, OK USA

Selective Serotonin Reuptake Inhibitors: Medical History of Fatally Injured Aviation Accident Pilots

Sen, Ahmet; Akin, Ahmet; Canfield, Dennis V; Chaturvedi, Arvind K; Jul 2007; 14 pp.; In English

Report No.(s): AD-A474552; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Selective serotonin reuptake inhibitors (SSRIs) are popularly prescribed for treating depression, but these antidepressants are not currently approved for use by U.S. civilian aviators. In a 2003 study, 4 SSRIs-citalopram, fluoxetine, paroxetine, and sertraline-have been found in 61 pilot fatalities of civil aviation accidents that occurred during 1990-2001. However, it was not known whether these pilots had disqualifying psychological conditions, including depression, and had properly reported the use of the antidepressants. The aeromedical history of the pilots was retrieved from the FAA's Medical Certification Database; additional pilot medical information and the cause/factor of the accidents were obtained from the National Transportation Safety Board's (NTSB's) Aviation Accident Database. Fifty-nine pilots had medical records in the FAA's Certification Database. The database did not contain medical records of 2 pilots-1 has never received a medical certificate and another had a Canadian pilot and medical certificate. Although driving under the influence was self-reported by 22 of the 59 pilots during their past aeromedical examinations, disqualifying psychological conditions were self-reported in the past examinations of only 7 (12%) of the 59 pilots, and the use of an SSRI was reported by 3 of the 7 pilots. In later examinations, 6 of the 7 indicated that they were free from the conditions and not taking SSRIs; thus, they were reissued medical certificates. Such conditions and/or drug use were not self-reported in the aeromedical records of the 52 (88%) pilots. Nevertheless, the NTSB investigations revealed that 12 (20%) of the 61 pilots had a history of a psychological condition and/or an SSRI use, as suggested by their personal medical records. Psychological conditions and/or the use of drugs were determined to be the cause or a factor in 16 (31%) of the 61 accidents. These findings reconfirm that SSRIs were used but not reported during medical examinations.

DTIC

Aircraft Accident Investigation; Aircraft Accidents; Drugs; Pilots; Serotonin

20080005334 Hanyang Univ., Gyeonggi-do, South Korea

Nonlinear Response Optimization Using Equivalent Loads for a Joined-Wing

Park, Gyung-Jin; Apr 2007; 38 pp.; In English

Report No.(s): AD-A474610; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Final report of research in geometric nonlinear response optimization of a joined-wing, carried out by using equivalent loads. The utilized structure is a joined-wing that is currently being developed in the US Air Force Research Laboratories (AFRL). The joined-wing is modeled for finite element analysis (FEA). Equivalent loads are the load sets which generate the same response field in linear analysis as that from nonlinear analysis.

DTIC

Gust Loads; Loads (Forces); Nonlinearity; Wings

20080005622 Air Univ., Maxwell AFB, AL USA

Strategic Studies Quarterly: An Air Force-Sponsored Strategic Forum for Military, Government, and Academic Professionals. Volume 1, Number 2

Dec 2007; 154 pp.; In English

Report No.(s): AD-A474774; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474774>

Contents: Air, Space, and Cyberspace Power for the Future? by Lt Gen Stephen R. Lorenz, USAF; Toward Restructuring National Security by Lt Gen David A. Deptula, USAF; Adapt or Die: The US Military's Responsibility to Protect America by Leading the Transformations in Science and Technology by Newt Gingrich with CAPT Ronald E. Weisbrook, USN; Irregular Warfare: One Nature, Many Characters by Colin S. Gray; Exploring the Knowledge Nexus: India's Path in Terrorism-Driven Institutional Growth by Chris C. Demchak and Eric Werner; Divine Victory for Whom? Airpower in the

2006 Israel-Hezbollah War by William M. Arkin; book reviews; and letters to the editor.
DTIC
Military Operations; Strategy

20080005670 Naval Postgraduate School, Monterey, CA USA

Collaborative Vehicles in Future Naval Missions, Obstacle Detection and Avoidance

Healey, Anthony J; Horner, Douglas P; Sep 2006; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-06-W-R20057

Report No.(s): AD-A474821; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this Keynote paper, the authors attempt to provide some overarching view of the needs for vehicle collaboration based on future Naval missions. Collaboration between differing types of autonomous vehicle, surface, ground, aerial and underwater will be required to achieve the utility in operations promised by the concepts to date. At NPS, we are also working on obstacle detection and avoidance for small AUVs which is a subject also discussed here. Recent advances in the development of low cost forward looking sonar arrays, has enabled the class of small Unmanned Underwater Vehicles to exhibit a capability for obstacle detection and avoidance. At NPS, the authors have studied the problems involved both using simulation models and through in water experimentation and validation. This paper reviews the concept of obstacle detection using a small 'Blazed Array' forward looking sonar 'FLS', illustrates the techniques used to analyze images obtained from an FLS, and perform threat assessment. The implementation of an avoidance controller in the NPS ARIES vehicle will be described along with a discussion of methodologies for vertical plane avoidance maneuvering. One particular strategy has been implemented and tested in the Underwater Test Range at Keyport, WA. The experiments performed will be discussed and analyzed. We show that one of the problems encountered arises when parts of the seabed are occluded from the sonar view. This leads to the notion of an uncertainty map being obtained from the FLS and used to drive the vertical response of the vehicle. Occlusion maps are built from the FLS data, and used to provide added maneuvering commands based on uncertainty. Vehicle response lags, normally a consideration with normal avoidance commands are mitigated using the FLS capability to look ahead.

DTIC

Avoidance; Obstacle Avoidance; Threat Evaluation; Underwater Vehicles

20080006150 Industrial Coll. of the Armed Forces, Washington, DC USA

Transportation

Allshouse, Michael; Armstrong, Fred; Burns, Stephen; Courts, Michael; Denn, Douglas; Fortunato, Paul; Gettings, Daniel; Hansen, David; Hoffman, Douglas; Jones, Robert; Jan 2007; 36 pp.; In English

Report No.(s): AD-A475112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475112>

Today, more than ever, the global economy depends on the efficient movement of people and cargo. The ability of the global transportation industry to rapidly move passengers and products from one corner of the globe to another continues to amaze even those wise to the dynamics of such operations. As globalization spreads and the demand for quicker, more robust transportation services increases, economies worldwide hang in the balance. This is largely because the economic prosperity of every nation is inextricably connected to the successful transportation of products from their point of origin to their point of consumption. As the global economy flourishes, more and more stress is placed on a transportation infrastructure that is unprepared to accommodate such extensive growth. Today, costly infrastructure expansion requirements affect all sectors of the transportation industry. As if the capacity issues were not enough, security of property and goods has now risen to the top of every transporter's priority list. The threat of continued terrorist attacks have forced security professionals in the industry to evolve their procedures from simple theft and contraband reduction to a counterterrorism focus across the entire transportation network. This study will briefly define the transportation industry, give a snapshot of each mode's performance and outlook, and then examine three cross-cutting issues prevalent throughout the transportation industry: capacity and congestion, security, and government involvement/participation.

DTIC

Air Transportation; Industries; Marine Transportation; Rail Transportation; Transportation

20080006332 Industrial Coll. of the Armed Forces, Washington, DC USA

Transportation

Adams, James; Carr, Ron; Chebl, Maroun; Coleman, Robert; Costantini, William; Cox, Robert; Dial, William; Jenkins, Robert; McGovern, James; Mueller, Peter; Jan 2006; 40 pp.; In English

Report No.(s): AD-A475252; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A flexible and productive transportation system is vital to America's economy and national security. The overarching trend of globalization continues to challenge America's transportation system; parenthetically, these demands may yield challenges that are still largely uncertain. The global economy is exponentially increasing demand on transportation infrastructure and the system must compensate by better integrating modalities (i.e., trains, ships, etc.) and maximizing intermodal efficiency. A healthy balance must be achieved between the flow of international commerce and security requirements regardless of transportation mode. The sector's voracious consumption of energy, particularly petroleum-based fuels, coupled with increased global demand will present intractable challenges in the foreseeable future. Transportation modes are expanding and evolving as a result of dramatic increases in demand for services throughout the industry. This study examines three significant crosscutting challenges to the overall transportation system: capacity and congestion, security, and energy. The 2006 Transportation Industry Study observed many areas of strength within the transportation network, and the potential for initiatives to enhance future national security and economic prosperity. The report contains three appendixes: Appendix A -- U.S. Seaport Congestion: The Need for Capacity and Capability Improvements; Appendix B -- Examination of U.S. Railroad Security Challenges: Post 9/11; and Appendix C -- The Greening of Commercial Trucking.

DTIC

Air Transportation; Forecasting; Industries; Marine Transportation; Rail Transportation; Security; Transportation

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.

20080002938 California Univ., Los Angeles, CA USA

Wind Tunnel and Water Channel Investigations for Improving MAV Aerodynamic Performance

Spedding, Geoffrey; Browand, Frederick; McArthur, John; May 14, 2007; 11 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0490

Report No.(s): AD-A473928; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473928>

Extensive investigations of the role of sweep in generating and/or stabilizing a leading edge vortex (LEV) in low Reynolds number ($Re = 10\,000$) aerodynamics were made by tracing dye over wing shapes in a low-turbulence water channel. Unlike any other experiment to date, the variation in sweep was the only parameter change, all others being fixed. The airfoil shape was a cambered plate, which is close to optimal at such Re . LEVs are not generated readily and are unlikely to be significant contributors to aerodynamic performance in fixed wing aircraft at this Re . The flows are complex and almost always involve significant spanwise components. The results are being used to guide current wind-tunnel based quantitative flow investigations in selected two-dimensional planes.

DTIC

Aerodynamic Characteristics; Aircraft Configurations; Fixed Wings; Water; Wind Tunnels

20080002963 Library of Congress, Washington, DC USA

F-35 Lightning II Joint Strike Fighter 'JSF' Program: Background, Status, and Issues

Murch, Anthony; Bolcom, Christopher; Oct 25, 2007; 33 pp.; In English

Report No.(s): AD-A473972; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473972>

The Defense Department's F-35 Lightning II Joint Strike Fighter (JSF) is one of three aircraft modernization programs in 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. Lockheed Martin won this competition and was selected to develop and produce the JSF, a family of aircraft including conventional take-off and landing (CTOL),

carrier-capable (CV), and short take-off vertical landing (STOVL) versions for the U.S. Air Force, Navy, and Marine Corps, the UK, as well as other allied services. Originally designated the Joint Advanced Strike Technology (JAST) program, the JSF program has attracted considerable attention in Congress because of concerns about its cost, effects on the defense industrial base, and implications for U.S. national security in the 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 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 strike aircraft that can be produced in affordable variants to meet different operational requirements. Developing an affordable tri-service family of CTOL (Air Force and Navy variants) and STOVL aircraft with different (but similar) combat missions poses major technological challenges.

DTIC

Fighter Aircraft; Lightning; Military Operations; Short Takeoff Aircraft

20080003023 Adelaide Univ., Australia

FGM (Functionally Graded Material) Thermal Barrier Coatings for Hypersonic Structures - Design and Thermal Structural Analysis

Ho, Sook-Ying; Kotousov, Andrei; Nguyen, Phuc; Harding, Steven; Codrington, John; Tsukamoto, Hideaki; Jun 29, 2007; 56 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0074

Report No.(s): AD-A474097; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474097>

A feasibility study of a relatively simple and economical method for producing functionally graded thermal barrier coatings using the Wet Powder (Slurry) and Sintering method showed promising results. This method is relatively undeveloped and under utilised compared to more expensive techniques such as chemical vapour deposition, physical vapour deposition, plasma spraying and powder metallurgy. It utilizes a pressurized spray gun to spray a slurry mixture of the powdered coating material suspended in a liquid solution directly onto a substrate surface followed by sintering using an oxyacetylene torch. The effects of slurry composition, type of ceramic powder, compatibility with substrates, spraying and sintering conditions were studied. Several TBC specimens have been fabricated under various conditions to develop a procedure which produce good quality coatings (of up to 3 layers) with little or no spallation. The optimum time, heat flux and applied pressure level for sintering were deduced. TBCs produced from a 40-45% ceramic, 4% binder and 0.4% dispersant composition and sintered for 30 minutes with an applied pressure of 30 MPa produced good quality coatings with a uniform and very smooth surface. Scanning electron micrographs of the fabricated TBC coatings showed good contact between the grain boundaries of the ceramic powder. In phase 2 of this project, the Wet Powder and Sintering method will be further developed. Improvements to this method include automating the sintering procedure and optimizing the fabrication conditions. A much more extensive micromechanical testing program will be conducted to obtain a more qualitative measure of the quality of the FGM thermal barrier coatings and to develop high temperature constitutive models for input into the FE modeling.

DTIC

Coating; Design Analysis; Functionally Gradient Materials; Hypersonics; Protective Coatings; Sintering; Slurries; Structural Analysis; Thermal Analysis; Thermal Control Coatings

20080003097 Arizona State Univ., Tempe, AZ USA

Advancing Detached-Eddy Simulation

Squires, Kyle D; Jan 2007; 110 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0030

Report No.(s): AD-A474225; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Measurements show that the flow over the Aerospatiale A-airfoil experiences a laminar separation in the vicinity of the leading edge region, just downstream of the peak negative pressure along the suction side. Transition occurs in the separated shear layer with the reattached turbulent boundary layer evolving further along the suction side prior to a subsequent separation near the trailing edge. The laminar separation and transition is accounted for using the triplex approach outlined by Travin (57). The triplex approach provides a means to accommodate the laminar separation and transition in the separated shear layer, in the present calculations represented by an activation of the turbulence model. The eddy viscosity upstream of the airfoil is zero, non-zero values are seeded into the suction side of the airfoil using a boundary layer trip.

DTIC

Airfoils; Simulation; Turbulence; Vortices

20080003104 Brigham Young Univ., Provo, UT USA

Integrated Flow Control Devices for the Design of Enhanced Low Pressure Turbines

Bons, Jeffrey P; Oct 17, 2007; 17 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0024

Report No.(s): AD-A474238; AFRL-SR-AR-TR-07-0506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Flow separation limits the efficiency of low-pressure turbines (LPTs) in aircraft engines. Experiments with vortex generator jets (VGJs), conducted in AFRL's low-speed cascade at Wright-Patterson AFB, have demonstrated dramatic reductions in separation losses. The critical science that will enable this design innovation to reach its potential is a comprehensive understanding of the effect of VGJs on a separating boundary layer. Experiments were conducted at BYU to better understand the basic physics of the separation control phenomenon and establish the quantitative links between the underlying flow physics and LPT performance. Understanding gained from these experiments was used to guide the design of a new, high-performance LPT blade at AFRL. The Air Force design codes used to generate the new airfoil included provisions for flow control using vortex generator jets. Experiments with the new profile confirmed the design goal of a 17% increase in blade loading compared to industry standard.

DTIC

Boundary Layer Separation; Control Equipment; Low Pressure; Separated Flow; Turbines; Vortex Generators

20080003138 Federal Aviation Administration, Atlantic City, NJ USA

FAA-NASA Sixth International Conference on the Continued Airworthiness of Aircraft Structures

Lautenberg, Frank; Domenici, Pete; Hinson, David; Donohue, George L; Billson, Margaret S; Held, Robert B; McBride, Tony; Vannoy, Robert D; Varanasi, S R; Morris, Michael J; Shepherd, William T; Walter, Patrick L; Register, Jeffrey; Bigelow, Catherine A; Tan, Paul W; Harris, Charles E; Starnes, Jr, James H; Newman, James C; Stacy, John J; Yu, Jin; Dec 1995; 238 pp.; In English

Report No.(s): AD-A474325; DOT/FAA/AR-95/86; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This publication contains the proceedings of the FAA-NASA Sixth International Conference on the Continued Airworthiness of Aircraft Structures. These conferences are held to disseminate information on the status of activities in transport and commuter aircraft certification, rule making, and airline maintenance related issues for both new and aging aircraft and to offer a forum for participation by all interested parties. The theme of the conference this year was the accomplishments of the past six years and how the successes can continue.

DTIC

Aircraft Reliability; Conferences; Maintenance; Structural Failure

20080003172 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Validation of FMTV Modular VHP/mVHP System and Fumigation Decontamination Process in a C-141B Starlifter Aircraft

Brickhouse, Mark D; Lalain, Teri A; Pfarr, Jerry W; Maclver, Brian K; Lloyd, John P; Flowers, James E; Mantooth, Brent A; Zander, Zach B; Stark, David C; Shue, Matthew J; Aug 2007; 124 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W9115R-04-C-0074

Report No.(s): AD-A474390; ECBC-TR-522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The C141 test was designed to further demonstrate that decontaminating substrates contaminated with chemical and biological warfare threat materials, while maintaining a near constant hydrogen peroxide/ammonia fumigant concentration (500 ppm/30 ppm) and varying exposure durations during separately timed runs, was reproducible. The test was also designed to demonstrate the ability to consistently achieve effective kills on materials contaminated with biological and chemical challenges set by the Joint Portable Interior Decontamination Program Operational Requirements Document. In addition, the next generation delivery system for vaporous hydrogen peroxide (VHP)/modified VHP (mVHP) (using a Medium Tactical Vehicle) was effective in performing the biological and chemical decontamination of a volume of 13,000 cu ft. The technical results are presented in this report.

DTIC

C-141 Aircraft; Decontamination; Fumigation; Hydrogen Peroxide

20080003332 Bihrl Applied Research, Inc., Jericho, NY USA

CJ2 Icing Effects Simulator. Delivery Order 0019: Development of an Icing Effects Simulation for a Typical Business Jet Configuration

Barnhart, Billy; Aug 2007; 94 pp.; In English

Contract(s)/Grant(s): F33615-98-D-3601-0019; Proj-A06M

Report No.(s): AD-A474414; BAR07-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this effort, Cessna Aircraft Company and Bihrl Applied Research teamed to develop and validate flight simulation models of a typical business jet incorporating the effects of various forms of ice. The ice conditions considered were: - Icing protection system failure ice - Inter-cycle (roughness) ice - Run-back ice. The study entailed wind tunnel tests of different scale wing panels with a wide range of Reynolds numbers to look at how ice effects scaled from a low-speed subscale model to the fullscale airplane. Complete airplane tests were then performed on a 1/12-scale model of the business jet to collect static and dynamic data required for development of a simulation model of the airplane with and without the various ice configurations. The wind tunnel data, properly adjusted for Reynolds number corrections, was used to construct simulation math models of the clean and iced airplane. In order to validate the models, a flight test program was undertaken to collect flight data the ice configurations. The math models were then incorporated into NASA's Ice Contamination Effects Flight Training Device and evaluated by the airframe manufacturer's test pilots. The simulator showed very good agreement with flight results for each of the ice conditions.

DTIC

Commerce; Commercial Aircraft; Ice; Ice Formation; Mathematical Models; Simulation; Simulators; Wind Tunnel Tests

20080003864 NASA Dryden Flight Research Center, Edwards, CA, USA

Preliminary Results from the QuietSpike Flight Test

Haering, Edward A., Jr.; Cliatt, Larry U. II; Howe, Don; Waithe, Kenrick; October 30, 2007; 33 pp.; In English; Fundamental Aeronautics Program 1st Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation reviews the QuietSpike flight test results. It shows the previous tests from Nearfield probes. The presentation then reviews the approach to test the QuietSpike, and shows graphics of the positions of the test vehicles. It also shows the components of the Sonic Boom Probing Noseboom. A graph of the Pressure Over- Under-shoot (Shaped Sonic Boom Demonstration (SSBD)Data) is presented. It reviews the Shock Probing Orientations, explaining that the probing plane is always behind the tail of the QuietSpike jet. Graphs of the Shock Position Geometry (SSBD Data) and the QuietSpike signature as of the test on 12/13/06, Near-Field Probing Directly Under the QuietSpike jet, and Near-Field Probing to Side, Near-Field Probing Above and to Side. Several slides review the Computational Fluid Dynamic models, and results compared to the probe tests.

CASI

Computational Fluid Dynamics; Flight Tests; Sonic Booms; Supersonic Flight; Spikes (Aerodynamic Configurations); Aerodynamic Noise; Supersonics

20080003889 NASA Glenn Research Center, Cleveland, OH, USA

Solar Airplanes and Regenerative Fuel Cells

Bents, David J.; October 09, 2007; 32 pp.; In English; 2007 Instrument Representative Information Services (IRIS) Group Show, Jan. 2007, Mayfield Heights, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 038957.04.01.03.03.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003889>

A solar electric aircraft with the potential to 'fly forever' has captured NASA's interest, and the concept for such an aircraft was pursued under Aeronautics Environmental Research Aircraft and Sensor Technology (ERAST) project. Feasibility of this aircraft happens to depend on the successful development of solar power technologies critical to NASA's Exploration Initiatives; hence, there was widespread interest throughout NASA to bring these technologies to a flight demonstration. The most critical is an energy storage system to sustain mission power during night periods. For the solar airplane, whose flight capability is already limited by the diffuse nature of solar flux and subject to latitude and time of year constraints, the feasibility of long endurance flight depends on a storage density figure of merit better than 400-600 watt-hr per kilogram. This figure of merit is beyond the capability of present day storage technologies (other than nuclear) but may be achievable in the hydrogen-oxygen regenerative fuel cell (RFC). This potential has led NASA to undertake the practical development of a hydrogen-oxygen regenerative fuel cell, initially as solar energy storage for a high altitude UAV science platform but eventually to serve as the primary power source for NASAs lunar base and other planet surface installations. Potentially the

highest storage capacity and lowest weight of any non-nuclear device, a flight-weight RFC aboard a solar-electric aircraft that is flown continuously through several successive day-night cycles will provide the most convincing demonstration that this technology's widespread potential has been realized. In 1998 NASA began development of a closed cycle hydrogen oxygen PEM RFC under the Aeronautics Environmental Research Aircraft and Sensor Technology (ERAST) project and continued its development, originally for a solar electric airplane flight, through FY2005 under the Low Emissions Alternative Power (LEAP) project. Construction of the closed loop system began in 2002 at the NASA Glenn Research Center in Cleveland, Ohio. System checkout was completed, and testing began, in July of 2003. The initial test sequences were done with only a fuel cell or electrolyzer in the test rig. Those tests were used to verify the test apparatus, procedures, and software. The first complete cycles of the fully closed loop, regenerative fuel cell system were successfully completed in the following September. Following some hardware upgrades to increase reactant recirculation flow, the test rig was operated at full power in December 2003 and again in January 2004. In March 2004 a newer generation of fuel cell and electrolyzer stacks was substituted for the original hardware and these stacks were successfully tested at full power under cyclic operation in June of 2004.

Author

Aeronautical Engineering; Research Aircraft; Regenerative Fuel Cells; Flight Tests; Solar Cells; Solar Energy; Fly By Wire Control

20080005233 RAND Corp., Santa Monica, CA USA

Measuring Effects of Payload and Radius Differences of Fighter Aircraft

Stanley, William; Liberson, Gary; Jan 1993; 88 pp.; In English

Contract(s)/Grant(s): F49620-91-C-0003

Report No.(s): AD-A474507; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research develops and applies an analytical framework to measure how inherent differences in F-15E and F-16C Block 50 payload and radius characteristics influence the ability of the two aircraft to deliver CBU- and GBU-class air-to-ground weapons against a variety of target sets. F-15Es and Block 50 F-16Cs both carried LANTIRN navigation and targeting pods for air-to-ground missions to provide a qualitatively comparable precision attack capability. Several alternative assumptions were made about F-16C carriage of external fuel tanks to assess their potential for improving radius and loiter capability. The F-16Cs carried either standard 370-gallon tanks or larger 610-gallon wing tanks that only the Israeli Air Force currently uses. Excursions were also run replacing the F-16C's centerline electronic countermeasures (ECM) pod with a 300-gallon external tank.

DTIC

Fighter Aircraft; Payloads; Radii

20080005245 Air War Coll., Maxwell AFB, AL USA

Integration of Weaponized Unmanned Aircraft into the Air-to-Ground System

Hume, David B; Sep 2007; 46 pp.; In English

Report No.(s): AD-A474541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Unmanned aircraft (UA) have changed the nature of warfare. Their persistence, economy, and utility make them indispensable on the battlefield, but the lines between the intelligence, surveillance, and reconnaissance (ISR) and ground attack missions of the UA are now blurred. Within the Air Force, the MQ-1 Predator does not fit seamlessly into the armed reconnaissance role. The ways ISR and ground attack assets are doctrinally resourced, tasked, and flown in support of requirements conflict with each other. The command and control (C2) structure of the theater air control system/Army air-ground system (TACS/AAGS) is not optimized to support the integration of UA operations required in tomorrow's battlespace. The Army is fielding the weaponized Warrior UA system, which crosses service lines into what is traditionally and clearly an Air Force mission. This study examines the issues of integrating weaponized UAs into the future battlespace from the standpoint of doctrine, operational concepts, and roles and missions. To address the disconnects in UA missions and systems, the Air Force must treat weaponized UAs like close air support and merge the Predator and Warrior requirements. Merging the programs will save money, and using the centralized control/decentralized execution tenant of airpower vice organic ownership can decrease the number of UAs required to support the mission effectively. This merger will require both services to establish firm acquisition numbers based on joint requirements. The services must establish a joint acquisition strategy for interoperability, airframe and spare part commonality, and cost savings. The study also recommends establishing joint employment standards and improving C2. Both services must evaluate how they command and control weaponized UAs.

The TACS/AAGS system must be modernized along the lines of a joint air-ground C2 cell to allow for near-real-time C2 and dynamic retasking of UAs to maximize employment.

DTIC

Command and Control; Drone Vehicles; Interoperability; Military Operations; Pilotless Aircraft; Predators

20080005247 Congressional Budget Office, Washington, DC USA

Costs of Expanding and Modernizing the Navy's Carrier-Based Air Forces

Shaw, Alan H; Haar, Patrick; Vogel, Robert L; May 1982; 90 pp.; In English

Report No.(s): AD-A474548; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To counter the growing threat of the Soviet navy, the Administration has announced its intention to reverse the long-term decline in the size of the U.S. Navy and otherwise improve Navy capabilities. It proposes to expand the U.S. fleet from the current 535 ships to roughly 600 and to increase the number of carrier-based air wings from 12 to 14. In addition to expanding, the Navy plans to modernize the existing carrier air forces, replacing 360 aircraft with more recent types, notably the F/A-18. This paper estimates the cost of the Navy's plan to expand and modernize its carrier air forces and examines alternatives to parts of that plan, while a companion Congressional Budget Office paper analyzes the shipbuilding issue.

DTIC

Aircraft Carriers; Attack Aircraft; Cost Estimates; Costs; Fighter Aircraft; Navy

20080005317 Congressional Budget Office, Washington, DC USA

Modernizing the Army's Rotary-Wing Aviation Fleet

Nov 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474583; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Toward the end of the Cold War, the Army's helicopter, or rotary-wing, fleet consisted of nearly 9,000 aircraft. Over the past 20 years, however, the fleet has contracted to its current strength of about 3,500 aircraft. Despite the elimination of many older helicopters and the modernization or replacement of others, most of the helicopters in today's fleet already exceed or soon will reach ages greater than the Army considers practical. The Army has embarked on a modernization plan that, by 2030, would address the aging of the fleet and introduce new capabilities by replacing or significantly upgrading nearly every helicopter in the fleet.

DTIC

Helicopters; Rotary Wings

20080005547 NASA Glenn Research Center, Cleveland, OH, USA

Fatigue Life of Haynes 188 Superalloy in Direct Connect Combustor Durability Rig

Gabb, Tim; Gayda, John; Webster, Henry; Ribeiro, Greg; November 2007; 16 pp.; In English; NASA Fundamental Aeronautics 2007, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.03.02.04.01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Direct Connect Combustor Durability Rig (DCR) will provide NASA a flexible and efficient test bed to demonstrate the durability of actively cooled scramjet engine structure, static and dynamic sealing technologies, and thermal management techniques. The DCR shall be hydrogen fueled and cooled, and test hydrogen cooled structural panels at Mach 5 and 7. Actively cooled Haynes 188 superalloy DCR structural panels exposed to the combustion environment shall have electrodischarge machined (EDM) internal cooling holes with flowing liquid hydrogen. Hydrogen combustion could therefore produce severe thermal conditions that could challenge low cycle fatigue durability of this material. The objective of this study was to assess low cycle fatigue capability of Haynes 188 for DCR application. Tests were performed at 25 and 650 C, in hydrogen and helium environments, using specimens with low stress ground (LSG) and electro-discharge machined (EDM) surface finish. Initial fatigue tests in helium and hydrogen indicate the low cycle fatigue life capability of Haynes 188 in hydrogen appears quite satisfactory for the DCR application. Fatigue capability did not decrease with increasing test temperature. Fatigue capability also did not decrease with EDM surface finish. Failure evaluations indicate retention of ductility in all conditions. Additional tests are planned to reconfirm these positive trends.

Author

Durability; Fatigue Life; Fatigue Tests; Heat Resistant Alloys; Supersonic Combustion Ramjet Engines; High Temperature

20080005558 NASA Glenn Research Center, Cleveland, OH, USA

Workshop on Jet Exhaust Noise Reduction for Tactical Aircraft - NASA Perspective

Huff, Dennis L.; Henderson, Brenda S.; November 27, 2007; 29 pp.; In English; NAVAIR Workshop, 11-17 Nov. 2007, Patuxent River, MD, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 526282.01.03.02.01.09; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005558>

Jet noise from supersonic, high performance aircraft is a significant problem for takeoff and landing operations near air bases and aircraft carriers. As newer aircraft with higher thrust and performance are introduced, the noise tends to increase due to higher jet exhaust velocities. Jet noise has been a subject of research for over 55 years. Commercial subsonic aircraft benefit from changes to the engine cycle that reduce the exhaust velocities and result in significant noise reduction. Most of the research programs over the past few decades have concentrated on commercial aircraft. Progress has been made by introducing new engines with design features that reduce the noise. NASA has recently started a new program called 'Fundamental Aeronautics' where three projects (subsonic fixed wing, subsonic rotary wing, and supersonics) address aircraft noise. For the supersonics project, a primary goal is to understand the underlying physics associated with jet noise so that improved noise prediction tools and noise reduction methods can be developed for a wide range of applications. Highlights from the supersonics project are presented including prediction methods for broadband shock noise, flow measurement methods, and noise reduction methods. Realistic expectations are presented based on past history that indicates significant jet noise reduction cannot be achieved without major changes to the engine cycle. NASA's past experience shows a few EPNdB (effective perceived noise level in decibels) can be achieved using low noise design features such as chevron nozzles. Minimal thrust loss can be expected with these nozzles (< 0.5%) and they may be retrofitted on existing engines. In the long term, it is desirable to use variable cycle engines that can be optimized for lower jet noise during takeoff operations and higher thrust for operational performance. It is also suggested that noise experts be included early in the design process for engine nozzle systems to participate in decisions that may impact the jet noise.

Author

Jet Aircraft Noise; Noise Measurement; Supersonic Aircraft; Prediction Analysis Techniques; Noise Reduction; Jet Exhaust; Exhaust Velocity; Aerodynamic Noise; Rotary Wings

20080005601 Congressional Budget Office, Washington, DC USA

Aerial Tanker Force Modernization

Mar 1982; 62 pp.; In English

Report No.(s): AD-A474723; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474723>

Last October, the Reagan Administration announced a plan to update U.S. strategic nuclear forces. A centerpiece of that program was a commitment to build two new strategic bombers over the next decade. The first, a modified form of the B-1 bomber (which had been cancelled by President Carter in 1977) would be fielded in 1986. The second, a new advanced technology bomber (ATB) incorporating 'stealth' technologies, would be deployed in the early 1990s. The current fleet of B-52s now being converted to carry cruise missiles will eventually be retired or retained as standoff cruise missile carriers as the new bombers enter service. Much public debate has focused on the bombers. As important as the bombers themselves, however, is the large fleet of tanker aircraft used to refuel bombers in flight. Bombers could not execute their missions without using tankers to extend their ranges. The bomber modernization program, and especially the plans to retire a major portion of B-52s, have tremendous implications for current tanker resources. Tankers also now figure prominently in conventional nonnuclear war plans, and they could prove indispensable, for instance, in projecting the Rapid Deployment Force (RDF) to distant theaters of operation. The need for substantial tanker capacity emerged especially clearly during the Arab-Israeli war in 1973, when U.S. airlift missions in support of Israel were nearly halted for the lack of mid-course refueling. These two sets of developments planned bomber development and the need not to rely on ground refueling have led to efforts to expand U.S. tanker resources.

DTIC

Bomber Aircraft; Tanker Aircraft

20080005625 Congressional Budget Office, Washington, DC USA

Naval Combat Aircraft: Issues and Options

Pierrot, Lane; Nov 1987; 96 pp.; In English

Report No.(s): AD-A474792; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474792>

Improvements in the U.S. naval forces are the centerpiece of the current Administration's conventional defense policy.

The Navy will soon have 600 ships, including 15 deployable aircraft carriers. According to the Administration, a naval force of this size is needed in a major European war to seize control of the northern Norwegian Sea, provide support to the defense of northern Norway, and also make the Soviet Union withhold forces that might otherwise be used against convoys involved in the resupply of Europe. The Navy refers to this approach as its forward offensive strategy. In addition, aircraft carriers are deployed worldwide in peacetime to carry out U.S. military objectives. While the Navy has already bought the ships to achieve a 600-ship Navy, it has not based on its own planning factors bought enough aircraft to meet the requirements of its 15 carriers. Even its current five-year plan would not alleviate the shortfalls in aircraft the difference between the Navy's stated requirements and its aircraft inventories. This suggests underutilization of expensive aircraft carriers in wartime. Moreover, that plan calls for average real growth in aircraft procurement costs of 7 percent a year from 1987 through 1992, while the latest Congressional budget plan calls for three years of real declines in overall defense spending. Thus, the Navy faces difficult choices as it attempts to procure enough aircraft within severe budgetary limits.

DTIC

Combat; Military Aircraft; Military Operations

20080005693 Air Force Research Lab., Wright-Patterson AFB, OH USA

A Flexible Hypersonic Vehicle Model Developed With Piston Theory (Preprint)

Oppenheimer, Michael W; Skujins, Torstens; Doman, David B; Bolender, Michael A; Jul 2007; 28 pp.; In English

Contract(s)/Grant(s): Proj-A03G

Report No.(s): AD-A474874; AFRL-VA-WP-TP-2007-319; No Copyright; Avail.: Defense Technical Information Center (DTIC)

For high Mach number flows, $M > 4$, piston theory has been used to calculate the pressures on the surfaces of a vehicle. In a two-dimensional inviscid flow, a perpendicular column of fluid stays intact as it passes over a solid surface. Thus, the pressure at the surface can be calculated assuming the surface were a piston moving into a column of fluid. In this work, first-order piston theory is used to calculate the forces, moments, and stability derivatives for longitudinal motion of a hypersonic vehicle. Piston theory predicts a relationship between the local pressure on a surface and the normal component of fluid velocity produced by the surface's motion. The advantage of piston theory over other techniques, such as Prandtl-Meyer flow, oblique shock, or Newtonian impact theory, is that unsteady aerodynamic effects can be included in the model. The unsteady effects, considered in this work, include perturbations in the linear velocities and angular rates, due to rigid body motion. A flexible vehicle model is developed to take into account the aeroelastic behavior of the vehicle. The vehicle forebody and aftbody are modeled as cantilever beams fixed at the center-of-gravity. Piston theory is used to account for the changes in the forces and moments due to the flexing of the vehicle. Piston theory yields an analytical model for the longitudinal motion of the vehicle, thus allowing design trade studies to be performed while still providing insight into the physics of the problem.

DTIC

Hypersonic Vehicles; Piston Theory

20080005806 Army Research Inst. for the Behavioral and Social Sciences, Fort Rucker, AL USA

Simulator Sickness During Emergency Procedures Training in a Helicopter Simulator: Age, Flight Experience, and Amount Learned

Johnson, David M; Sep 2007; 66 pp.; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A474563; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474563>

This research measured simulator sickness both before and after exposure to a helicopter simulator that was being used for emergency procedures training. Research issues were the incidence and magnitude of simulator sickness, after effects, susceptibility, and the effect of simulator sickness on training effectiveness. A total of 474 AH-64A (Apache) Army aviators participated in this research. The Simulator Sickness Questionnaire (SSQ) was administered prior to simulator exposure, immediately after simulator exposure, and twelve hours later. The incidence rate following simulator exposure was 68 percent. The SSQ Total Severity score was significantly larger immediately after exposure than it was prior to simulator exposure or twelve hours later. Age was significantly and positively correlated with SSQ score, after the effect of total flight hours was held constant. Flight hours did not correlate with SSQ score, after the effect of age was held constant. These results were consistent with postural instability theory. Both prior history of motion sickness and prior history of simulator sickness were significantly and positively correlated with SSQ score. The strongest susceptibility factor noted in this research was prior

history of simulator sickness. SSO score was not correlated with training effectiveness, as measured by a short behavioral test.
DTIC

Education; Emergencies; Experience; Flight Simulators; Flight Training; Helicopters; Motion Sickness

20080005847 Air Force Research Lab., Wright-Patterson AFB, OH USA

Decentralized Perimeter Surveillance Using a Team of Small UAVs (Preprint)

Kingston, Derek; Beard, Randal; Holt, Ryan; Sep 2007; 28 pp.; In English

Contract(s)/Grant(s): Proj-A03D

Report No.(s): AD-A474905; AFRL-RB-WP-TP-2007-324; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper poses the cooperative perimeter surveillance problem and offers a decentralized solution that accounts for perimeter growth (expanding or contracting) and insertion/deletion of team members. By identifying and sharing the critical coordination information and by exploiting the known communication topology, only a small communication range is required for accurate performance. Simulation and hardware results are presented that demonstrate the applicability of the solution.

DTIC

Drone Vehicles; Pilotless Aircraft; Surveillance

20080006104 Department of Defense, Washington, DC USA

Unmanned Systems Roadmap 2007-2032

Jan 2007; 189 pp.; In English

Report No.(s): AD-A475002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475002>

Today's military has seen an evolution in technology that is creating an entirely new capability to project power through the use of unmanned systems while reducing the risk to human life. The contributions of unmanned systems continue to increase. As of October 2006, coalition Unmanned Aircraft Systems (UASs), exclusive of hand-launched systems, had flown almost 400,000 flight hours in support of Operations Enduring Freedom and Iraqi Freedom, Unmanned Ground Vehicles (UGVs) had responded to over 11,000 Improvised Explosive Device (IED) situations, and Unmanned Maritime Systems (UMSs) had provided security to ports. As a result of these successes, the Quadrennial Defense Review (QDR) emphasized the importance of unmanned systems in the Global War on Terrorism (GWOT). Unmanned systems are highly desired by combatant commanders (COCOMs) for the many roles these systems can fulfill. Tasks such as mine detection; signals intelligence; precision target designation; chemical, biological, radiological, nuclear, explosive (CBRNE) reconnaissance; and communications and data relay rank high among the COCOMs' interests. These unmanned capabilities have helped reduce the complexity and time lag in the 'sensor' component of the sensor-to-shooter chain for prosecuting 'actionable intelligence.' Unmanned systems are changing the conduct of military operations in the GWOT by providing unrelenting pursuit combined with the elimination of threats to friendly forces; including injury, capture, or death.

DTIC

Detectors; Military Operations

20080006119 Congressional Budget Office, Washington, DC USA

Improving Strategic Mobility: The C-17 Program and Alternatives

Sep 1986; 74 pp.; In English

Report No.(s): AD-A475021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475021>

Strategic mobility is a critical element in U.S. military strategy. For political and economic reasons, the USA cannot maintain adequate forces abroad to meet all of its security commitments. Thus, it must be prepared to meet military aggression by rapidly deploying active and reserve units from their U.S. bases to the area where they are required, be it Europe, the Far East, Southwest Asia, or some unanticipated locale. Strategic mobility is provided in three ways--airlift, sea lift, and pre-positioning. Airlift is used to move units to combat theaters rapidly. Sealift, which has historically moved over 95 percent of cargo during wars, will continue to meet most of the requirement to deploy heavily equipped forces, as well as provide most of the supplies to sustain combat once troops are in position. Prepositioning equipment and supplies means to place them in or near potential areas of conflict, thereby reducing the need to transport these items. Military or civilian aircraft would then move troops to the sites where their equipment is waiting.

DTIC

Alternatives; Transport Aircraft

20080006283 Library of Congress, Washington, DC USA

Military Airlift: The Joint Cargo Aircraft Program

Knight, William; Dec 18, 2007; 7 pp.; In English

Report No.(s): AD-A475136; CRS-RS22776; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Joint Cargo Aircraft (JCA) is a joint acquisition program between the Army and the Air Force designed to procure a commercial off-the-shelf aircraft, capable of meeting Army requirements for 'direct support' to maneuver units and Air Force requirements for 'common-user' intra-theater airlift. The C-27J 'Spartan' has already won the JCA competition. Issues for Congress include requirements and service roles and missions.

DTIC

Cargo Aircraft; Commercial Off-the-Shelf Products; Government Procurement; Logistics Management; Support Systems; Transport Aircraft

20080006348 Defence Research and Development Canada, Valcartier, Quebec Canada

Getting Smarter at Managing Avionic Software: The Results of a Two-Day Requirements Elicitation Workshop With DTAES

Charland, P; Dessureault, D; Dussault, G; Lizotte, M; Michaud, F; Ouellet, D; Salois, M; Oct 2007; 64 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475286; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Managing avionic software effectively is a challenge with today's tools and resources. The Directorate of Technical Airworthiness and Engineering Support (DTAES) has recognized this and has approached DRDC Valcartier to address the problem from a technological standpoint. The team at DRDC Valcartier has considerable expertise in software engineering but, unfortunately at this point, very little in avionics. To offset this, a series of measures have been undertaken to ramp up this expertise (e.g. training, production of state-of-the-art reports). The first of these measures was the organization of a two-day workshop with DTAES and its partners to better define their requirements in avionics software management. This document highlights the results of this workshop, held in December 2006. The workshop used the Decision Support Services (DSS) collaborative laboratory, located at the National Defence Headquarters in Ottawa. This laboratory is built on the MeetingWorks toolset to provide each of the 11 participants with his own computer on which to give feedback on the four pre-identified domains (extraction, analysis, visualization, process support). From the outputs of these domains, the main tasks or problematic areas were identified and prioritized. These will be further investigated later, which could lead to relevant research projects and new engineering efforts within DRDC. Since DRDC Valcartier is a neophyte in this area, this document will not be an all-encompassing list of all avionic software engineering problems. It rather provides a summary of the most important requirements identified at the workshop. As DRDC Valcartier is currently negotiating with DTAES to improve various other aspects related to the air platforms, the document also provides an opportunity to spotlight potential openings for future collaboration to improve the whole avionic engineering process.

DTIC

Avionics; Computer Programming; Software Engineering

20080006463 NASA Glenn Research Center, Cleveland, OH, USA

Current Challenges for HTCMC Aero-Propulsion Components

DiCarlo, James A.; Bansal, Narottam P.; September 04, 2007; 20 pp.; In English; 6th International Conference on High Temperature Ceramic Matrix Composites (HTCMC-6), 4-7 Sep. 2007, New Delhi, India; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006463>

In comparison to the best metallic materials, HTCMC aero-propulsion engine components offer the opportunity of reduced weight and higher temperature operation, with corresponding improvements in engine cooling requirements, emissions, thrust, and specific fuel consumption. Although much progress has been made in the development of advanced HTCMC constituent materials and processes, major challenges still remain for their implementation into these components. The objectives of this presentation are to briefly review (1) potential HTCMC aero-propulsion components and their generic material performance requirements, (2) recent progress at NASA and elsewhere concerning advanced constituents and processes for meeting these requirements, (3) key HTCMC component implementation challenges that are currently being encountered, and (4) on-going activities within the new NASA Fundamental Aeronautics Program that are addressing these challenges.

Author

Combustion Products; Engine Parts; Aircraft Engines; Cooling

06

AVIONICS AND AIRCRAFT INSTRUMENTATION

Includes all avionics systems, cockpit and cabin display devices, and flight instruments intended for use in aircraft. For related information see also 04 Aircraft Communications and Navigation; 08 Aircraft Stability and Control; 19 Spacecraft Instrumentation and Astrionics; and 35 Instrumentation and Photography.

20080005540 NASA Glenn Research Center, Cleveland, OH, USA

Thin Film Ceramic Strain Sensor Development for Harsh Environments

Fralick, Gustave C.; Wrbanek, John D.; October 04, 2007; 23 pp.; In English; ISA Expo 2007, 2-4 Oct. 2007, Houston, TX, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698259.02.07.03.02; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005540>

The need to consider ceramic sensing elements is brought about by the temperature limits of metal thin film sensors in propulsion system applications. In order to have a more passive method of negating changes of resistance due to temperature, an effort is underway at NASA GRC to develop high temperature thin film ceramic static strain gauges for application in turbine engines, specifically in the fan and compressor modules on blades. Other applications include on aircraft hot section structures and on thermal protection systems. The near-term interim goal of this research effort was to identify candidate thin film ceramic sensor materials to test for viability and provide a list of possible thin film ceramic sensor materials and corresponding properties to test for viability. This goal was achieved by conducting a thorough literature search for ceramics that have the potential for application as high temperature thin film strain gauges chemically and physically compatible and selecting potential candidate materials for with NASA GRC's microfabrication procedures and substrates.

Author

Ceramics; Detection; High Temperature; Strain Gages; Thin Films

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.

20080003276 NASA Glenn Research Center, Cleveland, OH, USA

Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session

Hendricks, Robert C., Editor; May 2006; 152 pp.; In English; Seals/Secondary Fluid Flows Workshop 1997, 15-16 Oct. 1997, Cleveland, OH, USA; See also 20080003277 - 20080003281; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-27235; WBS 22-714-09-46

Report No.(s): NASA/CP-2006-214329/VOL2; E-15561-2; Copyright; Avail.: CASI: [A08](#), Hardcopy

The High Speed Civil Transport (HSCT) will be the largest engine ever built and operated at maximum conditions for long periods of time. It is being developed collaboratively with NASA, FAA, Boeing-McDonnell Douglas, Pratt & Whitney, and General Electric. This document provides an initial step toward defining high speed research (HSR) sealing needs. The overview for HSR seals includes defining objectives, summarizing sealing and material requirements, presenting relevant seal cross-sections, and identifying technology needs. Overview presentations are given for the inlet, turbomachinery, combustor and nozzle. The HSCT and HSR seal issues center on durability and efficiency of rotating equipment seals, structural seals and high speed bearing and sump seals. Tighter clearances, propulsion system size and thermal requirements challenge component designers.

Author

Supersonic Transports; Civil Aviation; Sealing; Inlet Nozzles; Turbomachinery; Combustion Chambers; Fluid Flow

20080003277 General Electric Co., Cincinnati, OH, USA

HSCT Anticipated Seal Needs Turbomachinery Seals Combustor Seals

Henry, John; Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session; May 2006, pp. 59-86; In English; See also [20080003276](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI:

[A03](#), Hardcopy

The High Speed Civil Transport (HSCT) engine concept is a large mixed flow turbofan similar in construction to current

military fighter engines. The mission, however, is quite different. The engine will operate for long periods of time at very high Mach numbers and high altitudes. The engine is required to have very low emissions and noise levels to be acceptable in commercial service. Current thrust levels are in the 55000 lb range. At the current supercruise speed requirement of Mach 2.4, the engine inlet temperature will be at least 380 F. This is the lowest cycle temperature expected anywhere in the propulsion system. Seals will be exposed to operate at this temperature and higher for thousands of hours without failure. Durability, cost, and weight will all be very important in determining the type of seals selected for a successful HSCT engine.

Author

Turbomachinery; Engine Design; Inlet Temperature; Multiphase Flow; Durability; Supersonic Transports; Engine Inlets

20080003278 United Technologies Corp., East Hartford, CT, USA

Seal Development for the HSCT Combustor

Jarmon, David C.; Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session; May 2006, pp. 87-110; In English; See also [20080003276](#); Original contains black and white illustrations; Copyright; Avail.: CASI:

[A03](#), Hardcopy

The combustor section of the High Speed Civil Transport (HSCT) requires high temperature seals to minimize leakage between CMC components. The temperature requirements range from 1500 F to 2100 F and the compression requirements range from 10% to 50%. Three distinctly different Nextel braided seals have been developed to seal areas such as the bulkhead heatshields and lean zone outer liner. The seals range from 0.10' dia. rope to triangular braid with 1' sides.

Author

Ceramic Matrix Composites; Supersonic Transports; High Temperature; Heat Shielding; Linings

20080003279 General Electric Co., Cincinnati, OH, USA

HSCT Exhaust System Anticipated Seal Needs

Vacek, Larry; Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session; May 2006, pp. 111-143; In English; See also [20080003276](#); Original contains black and white illustrations; Copyright; Avail.: CASI:

[A03](#), Hardcopy

The overview for HSR seals includes defining objectives, summarizing sealing and material requirements, presenting relevant seal cross-sections, and identifying technology needs. Overview presentations are given for the inlet, turbomachinery, combustor and nozzle. The HSCT and HSR seal issues center on durability and efficiency of rotating equipment seals, structural seals and high speed bearing and sump seals. Tighter clearances, propulsion system size and thermal requirements challenge component designers.

Author

Supersonic Transports; Exhaust Systems; Durability; Combustion Chambers; Turbomachinery; Sealing

20080003280 NASA Glenn Research Center, Cleveland, OH, USA

HSR Overview

Hendricks, R. C.; Steinetz, B. M.; Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session; May 2006, pp. 1-16; In English; See also [20080003276](#); Original contains black and white illustrations; Copyright; Avail.:

CASI: [A03](#), Hardcopy

The leading Aeronautics program within NASA is the High Speed Research Program (HSR). The HSR program's highest priorities are high pay-off technologies for airframe and propulsion systems required for a high speed civil transport (HSCT). These priorities have been developed collaboratively with NASA, FAA and the US Industry (Boeing-McDonnell Douglas, Pratt & Whitney and General Electric). Phase one of the HSR program started in 1990, and concentrated on the environmental challenges of minimizing NOx and noise. The first program goal is to reduce the NOx emission index to less than 5 (Concord NOx index is 20 and is unacceptable), in order to have little impact on the earth's ozone layer. The second goal is to reduce noise levels to FAR Stage 3 (or better), comparable to those of subsonic aircraft (far below the Concorde noise levels that require exemptions from less stringent standards). This requirement greatly impacts the nozzle design increasing its length and complexity and poses unique sealing challenges. Phase two started in 1993 and initiated work on the technologies required for an economical HSCT. Materials technologies under development include a ceramic-matrix-composite combustion liner, lightweight materials for the nozzle, as well long-life turbomachinery disk and blade alloys. Other required materials are being developed under the DOD-IHPTET program, where there is close cooperation. Economic goals translate into the development of technologies for tri-class service, 5000 nautical mile range aircraft with a ticket price no more than 20% over the subsonic ticket price. The potential market could be as large as 1500 aircraft, according to a Boeing study. Technology alone will not

enable this airplane, yet without enabling technologies 'on the shelf', it will not occur. The HSCT engine will be the largest engine ever built and operate at maximum conditions for long periods of time posing a number of challenges. The HSR engine mission requires that rotating equipment stay at take-off condition temperatures for hours not minutes per flight. Hence rotating equipment and seals must operate for many thousands of hours at extreme temperatures. It is anticipated that the nozzle will be 12 feet long and roughly 4 ft. by 5 ft. in cross-section with a nominal airflow of 800 lbs/sec. The complex function of the nozzle (including an ejector for noise attenuation) combined with long life place new demands on nozzle seal design. Three inlet configurations are under consideration with attendant sealing challenges, as will be illustrated herein. Four of these engines are required to propel a 5000 nautical mile class vehicle which demand that component reliability be at the highest possible level. In response, an HSR seals session was implemented as a part of the 1997-Seals and Secondary Flow Workshop. Overview presentations were given for each of the following areas: inlet, turbomachinery, combustor and nozzle. The HSCT seal issues center on durability and efficiency of rotating equipment seals (including brush seals), structural seals (including rope seals and other advanced concepts), and high-speed bearing and sump seals. Tighter clearances, propulsion system size and thermal requirements represent extremes that challenge the component designers. This document provides an initial step toward defining HSR seal needs. The overview for HSR seal designs includes, defining seal objectives, summarizing sealing and materials requirements, presenting relevant seal cross-sections, and identifying technology needs for the HSR office.

Author

NASA Programs; Civil Aviation; General Overviews; Supersonic Transports; High Speed; Technology Utilization

20080003281 Boeing Co., Seattle, WA, USA

Baseline HSR Inlet and Engine Bay Cowl Seal Requirements

Sandquist, David; Seals/Secondary Fluid Flows Workshop 1997; Volume II: HSR Engine Special Session; May 2006, pp. 17-58; In English; See also [20080003276](#); Original contains black and white illustrations; Copyright; Avail.: CASI:

[A03](#), Hardcopy

The two dimensional bifurcated inlet, down selected for the HSR program, and the engine bay cowling consist of many sealing interfaces. The variable geometry characteristics of this inlet and the size of the propulsion system impose new sealing requirements for commercial transport aircraft. Major inlet systems requiring seal development and testing include the ramp system, the bypass/take-off system, and the inlet/engine interface. Engine bay cowling seal interfaces include the inlet/cowling interface, the keel split line, the hinge beam/engine bay cowling, and the nozzle/cowling interface. These seals have to withstand supersonic flight operating temperatures and pressures with typical commercial aircraft reliability and lives. The operating conditions and expected seal lives will be identified for the various interfaces. Boeing's SST seal development program will also be discussed.

Author

Engine Inlets; Engine Design; Cowlings; Seals (Stoppers); Requirements; Civil Aviation; High Speed

20080003791 NASA Glenn Research Center, Cleveland, OH, USA

Seals/Secondary Fluid Flows Workshop 1997; Volume I

Hendricks, Robert C., Editor; August 2006; 511 pp.; In English; Seals/Secondary Fluid Flows Workshop 1997, 15-16 Oct. 1997, Cleveland, OH, USA; See also [20080003792](#) - [20080003816](#); Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 732759.03.01.02.15

Report No.(s): NASA/CP-2006-214329/VOL1; E-15561-1; Copyright; Avail.: CASI: [A22](#), Hardcopy

The 1997 Conference provided discussions and data on (a) program overviews, (b) developments in seals and secondary air management systems, (c) interactive seals flows with secondary air or fluid flows and powerstream flows, (d) views of engine externals and limitations, (e) high speed engine research sealing needs and demands, and (f) a short course on engine design development margins. Sealing concepts discussed include, mechanical rim and cavity seals, leaf, finger, air/oil, rope, floating-brush, floating-T-buffer, and brush seals. Engine externals include all components of engine fluid systems, sensors and their support structures that lie within or project through the nacelle. The clean features of the nacelle belie the minefield of challenges and opportunities that lie within. Seals; Secondary air flows; Rotordynamics; Gas turbine; Aircraft; CFD; Testing; Turbomachinery

Author

Sealing; Fluid Flow; Air Flow; Turbomachinery; Computational Fluid Dynamics; Gas Turbines; Rotor Dynamics; Brush Seals

20080003792 Toledo Univ., Toledo, OH, USA

Stability of the Wave Bearing on an Elastic Support

Dimofte, Florin; Keith, Theo G., Jr.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 235-251; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Numerical computation predicts that an elastic support can substantially improve the stability of the wave bearing if the dynamic stiffness and damping of this support are in a specific range of values. To experimentally validate this prediction, the housing of a gas bearing was mounted on elastic O-rings and the threshold of sub-synchronous whirl motion was experimentally observed when the bearing runs unloaded with a rotating speed up to 30,000 RPM. The O-ring system was also dynamically characterized by measuring its stiffness and damping at various frequencies up to 500 Hz. Good correlation exists between the experimental data and numerical prediction.

Author

Gas Bearings; Mathematical Models; O Ring Seals; Stability; Supports; Journal Bearings; Elastic Properties

20080003793 Texas A&M Univ., College Station, TX, USA

Liquid Annular Seal CFD Analysis for Rotordynamic Force Prediction

Moore, Jeff; Palazzolo, Alan; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 295-337; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A commercially available code is utilized to analyze a plain and grooved liquid annular seal. These type seals are commonly used in modern turbopumps and have a pronounced effect on the rotordynamic behavior of these systems. Accurate prediction of both leakage and dynamic reaction forces is vital to ensure good performance and sound mechanical operation. The code SCISEAL developed by CFDRC is a generic 3-D, finite volume based CFD code solving the 3-D Reynolds averaged Navier Stokes equations. The code allows body-fitted, multi-blocked structured grids, turbulence modeling, rotating coordinate frames, as well as integration of dynamic pressure and shear forces on the rotating journal. The code may be used with the commercially available pre-and post-processing codes from CFDRC as well.

Author

Rotor Dynamics; Dynamic Pressure; Computational Fluid Dynamics; Finite Volume Method; Leakage; Turbulence Models; Turbine Pumps

20080003794 NASA Glenn Research Center, Cleveland, OH, USA

Unsteady Analysis of Turbine Main Flow Coupled with Secondary Air Flow

Hah, Chunill; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 293; In English; See also [20080003791](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

Two numerical approaches are used to model the interaction between the turbine main gas flow and the wheelspace cavity seal flow. The 3-D, unsteady Reynolds-averaged Navier-Stokes equations are solved with a CFD code based on a structured grid to study the interaction between the turbine main gas flow and the wheelspace cavity seal flow. A CFD code based on an unstructured grid is used to solve detailed flow feature in the cavity seal which has a complex geometry. The numerical results confirm various observations from earlier experimental studies under similar flow conditions. When the flow rate through the rim cavity seal is increased, the ingestion of the main turbine flow into the rim seal area decreases drastically. However, a small amount of main gas flow is ingested to the rim seal area even with very high level of seal flow rate. This is due to the complex nature of 3-D, unsteady flow interaction near the hub of the turbine stage.

Author

Unsteady Flow; Air Flow; Cavity Flow; Turbines; Gas Flow; Flow Velocity; Navier-Stokes Equation; Reynolds Averaging; Computational Fluid Dynamics

20080003795 Boeing Co., Seattle, WA, USA

737/CFM56-7 Aircraft Engine Systems

Wright, Steve; Shiosaki, Justin; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 397-434; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The configuration of the propulsion system engine externals must meet many airplane requirements such as cost, thrust, weight, range and systems power extraction. On the 737-700 several program requirements also played a major role in the development of the engine externals. These program goals were increased range, same cost as a 1994 737-300, 15% reduction in maintenance costs from the 737-300, and a propulsion package that appeared as if it was designed by one company. This

presentation will show how these requirements shaped the design of the engine externals for the 737-700/CFM56-7B.

Author

Cost Reduction; Maintenance; Propulsion; Thrust; Costs

20080003796 Pratt and Whitney Aircraft, East Hartford, CT, USA

The Importance of Engine External's Health

Stoner, Barry L.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 435-443; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Engine external components include all the fluid carrying, electron carrying, and support devices that are needed to operate the propulsion system. These components are varied and include: pumps, valves, actuators, solenoids, sensors, switches, heat exchangers, electrical generators, electrical harnesses, tubes, ducts, clamps and brackets. The failure of any component to perform its intended function will result in a maintenance action, a dispatch delay, or an engine in flight shutdown. The life of each component, in addition to its basic functional design, is closely tied to its thermal and dynamic environment. Therefore, to reach a mature design life, the component's thermal and dynamic environment must be understood and controlled, which can only be accomplished by attention to design analysis and testing. The purpose of this paper is to review analysis and test techniques toward achieving good component health.

Author

Engine Parts; Thermal Environments; Heat Exchangers; Actuators; Design Analysis; Electronic Equipment; Maintenance; Propulsion; Failure

20080003797 Boeing Rocketdyne Propulsion Power, Canoga Park, CA, USA

Brush Seal Arrangement for the RS-68 Turbopump Set

Nunez, D.; Ransom, D.; Prueger, G.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 165-196; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The nature of the RS-68 turbopumps requires that the hydrogen seals separating the pump from the turbine must have extremely low levels of leakage and be contained in small packages. Conventional seal technologies are not able to reasonably satisfy such design requirements. A review of experimental measurements and analysis publications suggests that brush seals are well suited for the design requirements. Brush seals are shown to have less leakage than conventional labyrinth and damper seals and have no adverse effects on the rotordynamics of the machine. The bulk-flow analysis presented by Hendricks et al. is used as a guideline to create a spreadsheet that provides mass flow through the seal and heat generated by the rubbing contact of the bristles on the shaft. The analysis is anchored to published data for LN2 and LH2 leakage tests. Finally, the analysis is used to design seals for both applications. It is observed that the most important analysis parameter is the thickness of the bristle pack and its relationship to seal clearance, lay angle and pressure drop.

Author

Brush Seals; Turbine Pumps; Mass Flow; Rotor Dynamics; Liquid Hydrogen; Leakage

20080003798 WSA, Inc., Niskayuna, NY, USA

An Advanced Helium Buffer Seal for the SSME, ATD Oxygen Pump

Shapiro, Wilbur; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 197-233; In English; See also [20080003791](#); Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-97023; Copyright; Avail.: CASI: [A03](#), Hardcopy

The present configuration of Helium Buffer Seal on the ATD oxygen pump consists of a pair of opposed carbon rings are forced axially against their containment housings. Leakage occurs through the clearance between the rings and the shaft. The total helium leakage through both sides is approximately 239 SCFM. A reduction in leakage to 50 SCFM will result in less helium storage and consequently permit a substantial increase in payload. Under Phase 1 NASA SBIR, a solid T-Ring seal was analyzed and designed that could satisfy the criteria of reducing leakage to 50 SCFM or less. The design makes maximum use of available length and employs a mid length row of hydrostatic orifices that feed buffer helium directly into a 2 to 3 mil clearance region. The flow splits into opposite paths to buffer oxygen gas on one side and hydrogen gas on the turbine side. The seal employs opposed hydrostatic tapered land secondary seals that provide friction free support of the primary seal and allows the primary seal to follow rotor excursion and maintain concentric operating clearance. The predicted performance of the T-seal is excellent with operation at a safe film thickness of 2 to 2.5 mils and leakage less than 50 SCFM.

Author

Helium; Shafts (Machine Elements); Oxygen; Gas Turbines; Carbon; Hydrostatics; Leakage

20080003799 Pratt and Whitney Aircraft, West Palm Beach, FL, USA

Optimization of Turbine Rim Seals

Wagner, J. H.; Tew, D. E.; Stetson, G. M.; Sabnis, J. S.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 253-268; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Experiments are being conducted to gain an understanding of the physics of rim seal cavity ingestion in a turbine stage with the high-work, single-stage characteristics envisioned for Advanced Subsonic Transport (AST) aircraft gas turbine engines for the early 21st century. Initial experimental measurements to be presented include time-averaged turbine rim cavity and main gas path static pressure measurements for rim seal coolant to main gas path mass flow ratios between 0 and 0.02. The ultimate objective of this work is to develop improved rim seal design concepts for use in modern high-work, single stage turbines in order to minimize the use of secondary coolant flow. Toward this objective the time averaged and unsteady data to be obtained in these experiments will be used to 1) Quantify the impact of the rim cavity cooling air on the ingestion process. 2) Quantify the film cooling benefits of the rim cavity purge flow in the main gas path. 3) Quantify the impact of the cooling air on turbine efficiency. 4) Develop/evaluate both 3D CFD and analytical models of the ingestion/cooling process.

Author

Computational Fluid Dynamics; Turbines; Optimization; Three Dimensional Models; Cavity Flow; Rims; Seals (Stoppers)

20080003800 EG and G Pressure Science, Beltsville, MD, USA

Advanced Metallic Seal for High Temperature Applications

Nolan, Terence; Swensen, Jeff; Layer, Jeff; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 115-119; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The U-Plex(Registered TradeMark) was designed to allow greater elastic deflection capability in a given gland volume than the now conventional E-seal(Registered TradeMark). Greater deflection capability with the associated lower bending stresses provides several benefits. For pneumatic duct joints, the axial free height is increased to allow sealing of flanges with weld distortions significantly in excess of what could be tolerated with E-seals(Registered TradeMark). This performance is achieved while maintaining the reusability and ease of assembly typical of E-seal(Registered TradeMark) rigid duct joints.

Author

Bending Fatigue; Deflection; Sealing; Flanges; High Temperature; Distortion

20080003801 Westinghouse Electric Corp., Orlando, FL, USA

Advanced Seal Development for Large Industrial Gas Turbines

Chupp, Raymond E.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006; 17 pp.; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Efforts are in progress to develop advanced sealing for large utility industrial gas turbine engines (combustion turbines). Such seals have been under developed for some time for aero gas turbines. It is desired to transition this technology to combustion turbines. Brush seals, film riding face and circumferential seals, and other dynamic and static sealing approaches are being incorporated into gas turbines for aero applications by several engine manufacturers. These seals replace labyrinth or other seals with significantly reduced leakage rates. For utility industrial gas turbines, leakage reduction with advanced sealing can be even greater with the enormous size of the components. Challenges to transitioning technology include: extremely long operating times between overhauls; infrequent but large radial and axial excursions; difficulty in coating larger components; and maintenance, installation, and durability requirements. Advanced sealing is part of the Advanced Turbine Systems (ATS) engine development being done under a cooperative agreement between Westinghouse and the US Department of Energy, Office of Fossil Energy. Seal development focuses on various types of seals in the 501ATS engine both at dynamic and static locations. Each development includes rig testing of candidate designs and subsequent engine validation testing of prototype seals. This presentation gives an update of the ongoing ATS sealing efforts with special emphasis on brush seals.

Author

Brush Seals; Gas Turbine Engines; Systems Engineering; Leakage; Coating; Durability; Engine Tests; Sealing

20080003802 General Electric Corp. and Development, Niskayuna, NY, USA

Modeling and Full-Scale Testing of an Aspirating Face Seal

Turnquist, Norman A.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 39-58; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A 36" diameter aspirating face seal for aircraft engine application has undergone extensive testing and analysis. Previous

testing indicated that the seal tended to seek equilibrium at axial rotor clearances that were larger than expected. Parameter studies were conducted on several seal design parameters to evaluate effect on seal performance. Mixing of air flows from the air dam and air bearing regions of the seal was shown to have a significant impact on the seal's performance. Two methods of minimizing this flow interaction were studied both analytically and experimentally. The first method is to reduce the labyrinth tooth clearance, thereby limiting flow to the air dam itself. The second method involves utilizing a flow deflector between the air dam and air bearing regions of the seal in order to prevent radial flow from the air dam from disrupting the formation of a hydrostatic film at the air bearing. Both methods were shown to be effective design enhancements, allowing seal closure to be achieved. In both cases, the seal seeks an equilibrium position 0.0015' from the rotor surface, with corresponding low leakage rates.

Author

Vacuum; Labyrinth Seals; Gear Teeth; Air Flow; Gas Bearings; Computational Fluid Dynamics; Full Scale Tests; Three Dimensional Models

20080003803 NASA Glenn Research Center, Cleveland, OH, USA

Rotating Brush Seal

Lattime, S. B.; Braun, M. J.; Choy, F. K.; Hendricks, R. C.; Steinetz, B. M.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 93-102; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The proven technology of brush seals has been extended to the mitigation of problems arising from friction and wear at the bristle-rotor interface at high surface speeds. In prototype testing, the brush is mounted on, and free to rotate with the shaft, thus providing a complaint primary seal. A face seal positioned between the backing plate of the brush seal and the housing provides a secondary seal. The purpose of this paper is to demonstrate the interaction between the brush bristles and the shaft at high surface speeds as well as introduce a numerical model to simulate the bristle behavior. A test facility was constructed to study the effects of centrifugal forces on bristle deflection in a single rotating brush seal. The bristle-rotor interface was observed through a video camera, which utilized a high magnification borescope and a high frequency strobe light source. Rotational speeds of the rotor and the brush seal were measured by a magnetic and optical speed sensor, respectively. Preliminary results with speeds up to 11,000 rpm show no speed differential between the brush seal and rotor, or any instability problems associated with the brush seal. Bristle liftoff from the rotor is successfully captured on video.

Author

Brush Seals; Rotation; Technology Utilization; Test Facilities; Turbomachinery; Mathematical Models

20080003804 NASA Glenn Research Center, Cleveland, OH, USA

Finger Seal: A Novel Approach to Air to Air Sealing

Arora, Gul; Steinetz, Bruce; Proctor, Margaret; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 21-37; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The gas turbine industry used a variety of sealing mechanisms to contain and direct secondary flows into and around components for cooling, and to limit leakage into and from bearing and disk cavities. The function of these seals is very important to the component efficiencies and attendant engine performance. Most of these seals are labyrinth seals, which are high-leakage seals that are costly to manufacture. In recent years, brush seals have been introduced which have demonstrated significantly reduced leakage, although they are still expensive and have exhibited wear and hysteresis difficulties. A new innovative concept called finger seal, patented by AlliedSignal, has demonstrated leakage similar to brush seals and is cheaper. The finger seal is comprised of a stack of precision photo-etched sheet metal elements, which allows intricate features to be made at very low cost and with the potential to resist wear and provide the compliance necessary to accommodate rotor excursions. Initial testing in the high-speed/high-temperature seal test facility, at the NASA Lewis Research Center, has corroborated the finger seal performance. The testing also revealed hysteresis problems with the current design. A NASA funded research project is in progress to correct the functional deficiencies of the finger seal and to refine its features to provide sufficient seal life for commercial transport engines and other long-life applications. This research will benefit the aeronautical gas turbine industry as a whole in terms of fuel consumption, operational characteristics, and cost. The first phase of this research to reduce finger seal hysteresis has been in progress for the last one year. This paper presents the results of this research to date. In future the research program will address seal performance, manufacturing, cost and life issues. The research program is expected to be completed by December 1998.

Author

Brush Seals; Sealing; Gas Turbines; Aeronautical Engineering

20080003805 NASA Glenn Research Center, Cleveland, OH, USA

Numerical Methodology for Coupled Time-Accurate Simulations of Primary and Secondary Flowpaths in Gas Turbines

Przekwas, A. J.; Athavale, M. M.; Hendricks, R. C.; Steinetz, B. M.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 269-292; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Detailed information of the flow-fields in the secondary flowpaths and their interaction with the primary flows in gas turbine engines is necessary for successful designs with optimized secondary flow streams. Present work is focused on the development of a simulation methodology for coupled time-accurate solutions of the two flowpaths. The secondary flowstream is treated using SCISEAL, an unstructured adaptive Cartesian grid code developed for secondary flows and seals, while the mainpath flow is solved using TURBO, a density based code with capability of resolving rotor-stator interaction in multi-stage machines. An interface is being tested that links the two codes at the rim seal to allow data exchange between the two codes for parallel, coupled execution. A description of the coupling methodology and the current status of the interface development is presented. Representative steady-state solutions of the secondary flow in the UTRC HP Rig disc cavity are also presented.

Author
Flow Distribution; Gas Turbine Engines; Numerical Analysis; Secondary Flow; Computerized Simulation; Time Dependence

20080003806 San Francisco International Airport, San Francisco, CA, USA

Commercial Aircraft Maintenance Experience Relating to Engine External Hardware

Soditus, Sharon M.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 381-395; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Airlines are extremely sensitive to the amount of dollars spent on maintaining the external engine hardware in the field. Analysis reveals that many problems revolve around a central issue, reliability. Fuel and oil leakage due to seal failure and electrical fault messages due to wire harness failures play a major role in aircraft delays and cancellations (D&C's) and scheduled maintenance. Correcting these items on the line requires a large investment of engineering resources and manpower after the fact. The smartest and most cost effective philosophy is to build the best hardware the first time. The only way to do that is to completely understand and model the operating environment, study the field experience of similar designs and to perform extensive testing.

Author

Airline Operations; Commercial Aircraft; Cost Effectiveness; Reliability; Maintenance; Electrical Faults

20080003807 Boeing Co., Seattle, WA, USA

Adapting Analysis Tools to Engine External Analysis

Dunkelberg, Ken; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 363-380; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Market forces are driving industry to reproduce product cycle time (the time required to conceive, design, build, test, validate and deliver a product). Application of existing tools in new areas can reduce the time required to design a new product and increase the confidence of acceptable test results later in the expensive testing and validation phase. Finite element methods, computational fluid dynamics codes and sharing of CAD datasets when applied to the design of engine externals can provide methods for product improvement and expedited delivery to the customer.

Author

Computational Fluid Dynamics; Finite Element Method

20080003808 General Electric Aircraft Engines, Cincinnati, OH, USA

LM2500+ Brush Seal Case Study

Haaser, Fred G.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 123-146; In English; See also [20080003791](#); Copyright; Avail.: CASI: [A03](#), Hardcopy

The LM2500+ industrial aeroderivative gas turbine, a 25% enhanced power derivative of the LM2500 gas turbine, recently completed its development test program during the period 5/96 - 10/96. Early in the engine program a Quality Function Deployment (QFD) process was used to determine customer needs for this project. The feedback obtained from the QFD process showed without doubt that gas turbine customers now emphasize product reliability and availability at the top of their needs. One area of development on the LM2500+ was to investigate the use of a brush seal as a means to reduce undesirable turbine cooling leakages within the turbine mid frame in order to enhance part life. This presentation presents a

case study on the factors that went into evaluating a brush seal during engine test, test results, and the ultimate decision not to implement the brush seal for cost and other reasons.

Author

Brush Seals; Gas Turbines; Engine Tests; Reliability; Cooling

20080003809 Boeing Co., Seattle, WA, USA

Turbofan Engine Core Compartment Vent Aerodynamic Configuration Development Methodology

Hebert, Leonard J.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 339-362; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This paper presents an overview of the design methodology used in the development of the aerodynamic configuration of the nacelle core compartment vent for a typical Boeing commercial airplane together with design challenges for future design efforts. Core compartment vents exhaust engine subsystem flows from the space contained between the engine case and the nacelle of an airplane propulsion system. These subsystem flows typically consist of precooler, oil cooler, turbine case cooling, compartment cooling and nacelle leakage air. The design of core compartment vents is challenging due to stringent design requirements, mass flow sensitivity of the system to small changes in vent exit pressure ratio, and the need to maximize overall exhaust system performance at cruise conditions.

Author

Exhaust Systems; Design Analysis; Aerodynamic Configurations; Vents; Turbofan Engines; Pressure Ratio; Nacelles; Mass Flow; Cooling

20080003810 NASA Glenn Research Center, Cleveland, OH, USA

NASA High Temperature Turbine Seal Rig Development

Steinetz, Bruce M.; Proctor, Margaret P.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 69-82; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation describes a turbine seal rig concept to meet next generation engine speed and temperatures requirements. The contents include: 1) Turbomachinery Seal Development Objectives; 2) High Temperature Turbomachinery Seal Test Rig; 3) Test Parameters; 4) Highlights of Engineering Calculations; 5) Seal Rig Global Thermal Analysis; 6) Test Rig Status; 7) Seal Rig Schematic; 8) Test Chamber Enlarged View; and 9) Rig Features Unique Measurement Systems.

CASI

Turbomachinery; Seals (Stoppers); Fabrication; Engine Design; Test Facilities; Thermal Analysis

20080003811 Pratt and Whitney Aircraft, West Palm Beach, FL, USA

Effects of ‘Cooled’ Cooling Air on Pre-Swirl Nozzle Design

Scricca, J. A.; Moore, K. D.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 83-92; In English; See also [20080003791](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

It is common practice to use Pre-Swirl Nozzles to facilitate getting the turbine blade cooling air onboard the rotating disk with minimum pressure loss and reduced temperature. Higher engine OPR's and expanded aircraft operating envelopes have pushed cooling air temperatures to the limits of current disk materials and are stressing the capability to cool the blade with practical levels of cooling air flow. Providing ‘Cooled’ Cooling Air is one approach being considered to overcome these limitations. This presentation looks at how the introduction of ‘Cooled’ Cooling Air impacts the design of the Pre-Swirl Nozzles, specifically in relation to the radial location of the nozzles.

Author

Cooling; Nozzle Design; Seals (Stoppers); Air Flow; Secondary Flow; Swirling

20080003812 Allison Engine Co., Indianapolis, IN, USA

Advanced Seals and Secondary Airflow Systems for Allison AST

Munson, John; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 1-19; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The author will present results obtained to date of a secondary flow study currently being conducted. The purpose of the study is to investigate and report all the ramifications of introducing advanced sealing technology into gas turbine engine secondary flow systems. In addition to detailed cost/benefit results we will also derive seal operational requirements which can be fed into a subsequent advanced seal development program. Using the current Allison AE3007 engine as a model/baseline

we have examined 6 different advanced seal variations. We have settled on a design with 2 advanced seals which results in a savings of 2% in chargeable cooling. The introduction of these advanced seals has resulted in substantial changes to surrounding engine components which will be reported.

Author

Air Flow; Subsonic Aircraft; Seals (Stoppers); Systems Engineering; Turbofan Engines; Secondary Flow

20080003813 Allied-Signal Engines and Systems, Phoenix, AZ, USA

Air/Oil Seals R and D at AlliedSignal

Ullah, M. Rifat; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 59-68; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

AlliedSignal aerospace company is committed to significantly improving the reliabilities of air/oil seals in their gas turbine engines. One motivation for this is that aircraft cabin air quality can be affected by the performance of mainshaft air/oil seals. In the recent past, coking related failure modes have been the focus of air/oil seal R&D at AlliedSignal. Many significant advances have been made to combat coke related failures, with some more work continuing in this area. This year's R&D begins to address other common failure modes. Among them, carbon seal 'blistering' has been a chronic problem facing the sealing industry for many decades. AlliedSignal has launched an aggressive effort this year to solve this problem for our aerospace rated carbon seals in a short (one to two year) timeframe. Work also continues in developing more user-friendly tools and data for seal analysis & design. Innovations in seal cooling continue. Nominally non-contacting hydropad sealing concept is being developed for aerospace applications. Finally, proprietary work is in planning stages for development of a seal with the aggressive aim of zero oil leakage.

Author

Aerospace Engineering; Gas Turbine Engines; Oils; Seals (Stoppers); Sealing; Air Flow; Research and Development

20080003814 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Compression, Staging, and Braid Angle on Braided Rope Seal Performance

Steinetz, Bruce M.; Dunlap, Patrick H.; Adams, Michael L.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 103-114; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation describes the effects of compression, staging and braid angle on braided rope seals. The contents include: 1) Test Fixture Schematics; 2) Comparison of Hybrid Seal Braid Architecture; 3) Residual Interference After Compression Cycling; 4) Effect of Compression, Braid, and Staging on Seal Flow; 5) Effect of Staging on Seal Pressure Drop; 6) Three Stag Seal Durability; 7) P&W Turbine Vane Seal Requirements; and 8) Next Generation Fighter F-22 P&W F119 Engines.

CASI

Compressibility Effects; Seals (Stoppers); Aircraft Engines; Aerospace Engineering; Braided Composites; F-22 Aircraft

20080003815 Universal Technology Corp., Dayton, OH, USA

Engine Development Design Margins Briefing Charts

Bentz, Chuck; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 445-500; In English; See also [20080003791](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A04](#), Hardcopy

New engines experience durability problems after entering service. The most prevalent and costly is the hot section, particularly the high-pressure turbine. The origin of durability problems can be traced back to: 1) the basic aero-mechanical design systems, assumptions, and design margins used by the engine designers, 2) the available materials systems, and 3) to a large extent, aggressive marketing in a highly competitive environment that pushes engine components beyond the demonstrated capability of the basic technology available for the hardware designs. Unfortunately the user must operate the engine in the service environment in order to learn the actual thrust loading and the time at max effort take-off conditions used in service are needed to determine the hot section life. Several hundred thousand hours of operational service will be required before the demonstrated reliability of a fleet of engines or the design deficiencies of the engine hot section parts can be determined. Also, it may take three to four engine shop visits for heavy maintenance on the gas path hardware to establish cost effective build standards. Spare parts drive the operator's engine maintenance costs but spare parts also makes lots of money for the engine manufacturer during the service life of an engine. Unless competition prevails for follow-on engine buys, there is really no motivation for an OEM to spend internal money to improve parts durability and reduce earnings derived from a lucrative spare parts business. If the hot section life is below design goals or promised values, the OEM might argue that the

engine is being operated beyond its basic design intent. On the other hand, the airframer and the operator will continue to remind the OEM that his engine was selected based on a lot of promises to deliver spec thrust with little impact on engine service life if higher thrust is used intermittently. In the end, a standoff prevails and nothing gets fixed. This briefing will propose ways to hold competing engine manufacturers more accountable for engine hot section design margins during the entire Engine Development process as well as provide tools to assess the design temperature margins in the hot section parts of Service Engines.

Derived from text

Charts; Engine Design; Mechanical Engineering; Systems Engineering; Technology Utilization

20080003816 EG and G Mechanical Components Technology Group, Cranston, RI, USA

Development of a Thin Gauge Metallic Seal for Gas Turbine Engine Applications to 1700 F

England, Raymond O.; Seals/Secondary Fluid Flows Workshop 1997; Volume I; August 2006, pp. 121; In English; See also [20080003791](#); Copyright; Avail.: CASI: [A01](#), Hardcopy

The goal of doubling thrust-to-weight ratio for gas turbine engines has placed significant demands on engine component materials. Operating temperatures for static seals in the transition duct and turbine sections for instance, may well reach 2000 F within the next ten years. At these temperatures conventional age-hardenable superalloys lose their high strength via overaging and eventual dissolution of the gamma precipitate, and are well above their oxidation stability limit. Conventional solid-solution-strengthened alloys offer metallurgical stability, but suffer from rapid oxidation and little useful load bearing strength. Ceramic materials can theoretically be used at these temperatures, but manufacturing processes are in the developmental stages.

Author

Heat Resistant Alloys; Operating Temperature; Compressive Strength; Thrust-Weight Ratio; Precipitation Hardening; Gas Turbine Engines; Ducts

20080003892 NASA Glenn Research Center, Cleveland, OH, USA

High Altitude Emissions

Bulzan, Dan; October 31, 2007; 11 pp.; In English; NASA Fundamental Aeronautics Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003892>

An overview of emissions related research being conducted as part of the Fundamental Aeronautics Supersonics Project is presented. The overview includes project objectives, milestones, and descriptions of major research areas. The overview also includes information on the emissions research being conducted under NASA Research Announcements. Technical challenges include: 1) Environmental impact of supersonic cruise emissions is greater due to higher flight altitudes which makes emissions reduction increasingly important. 2) Accurate prediction tools to enable combustor designs that reduce emissions at supersonic cruise are needed as well as intelligent systems to minimize emissions. 3) Combustor operating conditions at supersonic cruise are different than at subsonic cruise since inlet fuel and air temperatures are considerably increased.

Author

High Altitude; Environmental Surveys; Supersonics; Flight Altitude

20080003894 NASA Glenn Research Center, Cleveland, OH, USA

Combustion

Bulzan, Dan; October 31, 2007; 28 pp.; In English; NASA Fundamental Aeronautics Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.04; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003894>

An overview of the emissions related research being conducted as part of the Fundamental Aeronautics Subsonics Fixed Wing Project is presented. The overview includes project metrics, milestones, and descriptions of major research areas. The overview also includes information on some of the emissions research being conducted under NASA Research Announcements. Objective: Development of comprehensive detailed and reduced kinetic mechanisms of jet fuels for chemically-reacting flow modeling. Scientific Challenges: 1) Developing experimental facilities capable of handling higher hydrocarbons and providing benchmark combustion data. 2) Determining and understanding ignition and combustion

characteristics, such as laminar flame speeds, extinction stretch rates, and autoignition delays, of jet fuels and hydrocarbons relevant to jet surrogates. 3) Developing comprehensive kinetic models for jet fuels.

Derived from text

Combustion; Spontaneous Combustion; Reacting Flow; Laminar Flow; Ignition

20080005526 NASA Glenn Research Center, Cleveland, OH, USA

Supersonic Cruise Efficiency - Propulsion Tech Challenge Overview

DeBonis James R.; October 30, 2007; 15 pp.; In English; NASA Fundamental Aeronautics Program Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.05; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005526>

This presentation provides a brief overview of the research underway in the Cruise Efficiency -- Propulsion technical challenge area of NASA's Fundamental Aeronautics Supersonics project. The research involves both computational and experimental efforts in the areas of Advanced Inlet Concepts, High Performance/Wide Operability Fan and Compressors, Advanced Nozzle Concepts and Intelligent Sensors/Actuators. The work consists of both internal NASA research and external efforts funded through the NASA Research Announcement process.

Author

Propulsion; Supersonic Flight; Propulsion System Performance; Cruising Flight

20080005559 NASA Glenn Research Center, Cleveland, OH, USA

Conceptual Design and Feasibility of Foil Bearings for Rotorcraft Engines: Hot Core Bearings

Howard, Samuel A.; October 30, 2007; 33 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 877868.02.07.03.01.01; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005559>

Recent developments in gas foil bearing technology have led to numerous advanced high-speed rotating system concepts, many of which have become either commercial products or experimental test articles. Examples include oil-free microturbines, motors, generators and turbochargers. The driving forces for integrating gas foil bearings into these high-speed systems are the benefits promised by removing the oil lubrication system. Elimination of the oil system leads to reduced emissions, increased reliability, and decreased maintenance costs. Another benefit is reduced power plant weight. For rotorcraft applications, this would be a major advantage, as every pound removed from the propulsion system results in a payload benefit. Implementing foil gas bearings throughout a rotorcraft gas turbine engine is an important long-term goal that requires overcoming numerous technological hurdles. Adequate thrust bearing load capacity and potentially large gearbox applied radial loads are among them. However, by replacing the turbine end, or hot section, rolling element bearing with a gas foil bearing many of the above benefits can be realized. To this end, engine manufacturers are beginning to explore the possibilities of hot section gas foil bearings in propulsion engines. This overview presents a logical follow-on activity by analyzing a conceptual rotorcraft engine to determine the feasibility of a foil bearing supported core. Using a combination of rotodynamic analyses and a load capacity model, it is shown to be reasonable to consider a gas foil bearing core section. In addition, system level foil bearing testing capabilities at NASA Glenn Research Center are presented along with analysis work being conducted under NRA Cooperative Agreements.

Author

Foil Bearings; Gas Turbine Engines; Rotary Wing Aircraft; Lubrication Systems; High Speed; Gas Bearings; Thrust Bearings

20080005584 NASA Glenn Research Center, Cleveland, OH, USA

Integration of On-Line and Off-Line Diagnostic Algorithms for Aircraft Engine Health Management

Kobayashi, Takahisa; Simon, Donald L.; ASME Journal of Engineering for Gas Turbines and Power; October 2007; Volume 129, pp. 986-993; In English; ASME Turbo Expo 2007: Land, Sea and Air (GT2007), 14-17 May 2007, Montreal, Quebec, Canada; Original contains color illustrations

Contract(s)/Grant(s): NNC06BA07B; WBS 122711.03.1.03.04.01; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1115/1.2747640>

This paper investigates the integration of on-line and off-line diagnostic algorithms for aircraft gas turbine engines. The on-line diagnostic algorithm is designed for in-flight fault detection. It continuously monitors engine outputs for anomalous signatures induced by faults. The off-line diagnostic algorithm is designed to track engine health degradation over the lifetime of an engine. It estimates engine health degradation periodically over the course of the engine's life. The estimate generated

by the off-line algorithm is used to 'update' the on-line algorithm. Through this integration, the on-line algorithm becomes aware of engine health degradation, and its effectiveness to detect faults can be maintained while the engine continues to degrade. The benefit of this integration is investigated in a simulation environment using a nonlinear engine model.

Author

On-Line Systems; Gas Turbine Engines; Fault Detection; Degradation; Measure and Integration; Estimates

20080005824 Air Force Research Lab., Wright-Patterson AFB, OH USA

Advanced Propulsion Concepts and Component Technologies

Stutrud, Jeffrey S; Jul 2007; 7 pp.; In English

Contract(s)/Grant(s): FA8650-04-3-9009; Proj-3066

Report No.(s): AD-A474841; AFRL-RZ-WP-TM-2007-2138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This technical memorandum summarizes the activities of a cost-shared project order entitled 'Advanced Propulsion Concepts and Component Technologies' dated 14 June 2004 under an AFRL MOU/PIA (Memorandum of Understanding/ Partnership Intermediary Agreement) dated 17 March 2003 with the Wright Brothers Institute (WBI) located in Dayton, Ohio. The program was structured as a one year effort to develop a plan for cooperative research partnered with The Ohio State University. An optional four year follow-on effort may be pursued to conduct the proposed research. The objective and scope of this research was to define and investigate advanced propulsion concepts and component technologies that could provide improvements in gas turbine engines and advanced propulsion systems for manned and unmanned systems to enhance the mission of PR. This could include technologies associated with gas turbine engines, combined cycle engines, near-constant temperature cycle turbine engines, and pulsed detonation engines or other related areas of interest to the Air Force.

DTIC

Gas Turbines; Propulsion; Turbojet Engines

20080006055 NASA Glenn Research Center, Cleveland, OH, USA

Status of Superheated Spray and Post Combustor Particulate Modeling for NCC

Liu, Nan-Suey; Raju, Suri; Wey, Thomas; October 30, 2007; 24 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.02; Copyright; Avail.: CASI: A03, Hardcopy

At supersonic cruise conditions, high fuel temperatures, coupled with low pressures in the combustor, create potential for superheated fuel injection leading to shorter fuel jet break-up time and reduced spray penetration. Another issue particularly important to the supersonic cruise is the aircraft emissions contributing to the climate change in the atmosphere. Needless to say, aircraft emissions in general also contribute to the air pollution in the neighborhood of airports. The objectives of the present efforts are to establish baseline for prediction methods and experimental data for (a) liquid fuel atomization and vaporization at superheated conditions and (b) particle sampling systems and laboratory or engine testing environments, as well as to document current capabilities and identify gaps for future research.

Author

Combustion Chambers; Prediction Analysis Techniques; Liquid Fuels; Atomizing; Engine Tests; Fuel Injection; High Temperature; Vaporizing

20080006063 NASA Glenn Research Center, Cleveland, OH, USA

Hypersonic Vehicle Propulsion System Simplified Model Development

Stueber, Thomas J.; Raitano, Paul; Le, Dzu K.; Ouzts, Peter; October 30, 2007; 10 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 599489.02.07.03.05.04; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006063>

This document addresses the modeling task plan for the hypersonic GN&C GRC team members. The overall propulsion system modeling task plan is a multi-step process and the task plan identified in this document addresses the first steps (short term modeling goals). The procedures and tools produced from this effort will be useful for creating simplified dynamic models applicable to a hypersonic vehicle propulsion system. The document continues with the GRC short term modeling goal. Next, a general description of the desired simplified model is presented along with simulations that are available to varying degrees. The simulations may be available in electronic form (FORTRAN, CFD, MatLab,...) or in paper form in

published documents. Finally, roadmaps outlining possible avenues towards realizing simplified model are presented.

Author

Hypersonic Vehicles; Systems Engineering; Propulsion; Computational Fluid Dynamics; Dynamic Models

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.

20080003275 NASA Dryden Flight Research Center, Edwards, CA, USA

Autonomous Airborne Refueling Demonstration, Phase I Flight-Test Results

Dibley, Ryan P.; Allen, Michael J.; Nabaa, Nassib; December 2007; 31 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2007-214632; H-2799; Copyright; Avail.: CASI: [A03](#), Hardcopy

The first phase of the Autonomous Airborne Refueling Demonstration (AARD) project was completed on August 30, 2006. The goal of this 15-month effort was to develop and flight-test a system to demonstrate an autonomous refueling engagement using the Navy style hose-and-drogue air-to-air refueling method. The prime contractor for this Defense Advanced Research Projects Agency (DARPA) sponsored program was Sierra Nevada Corporation (SNC), Sparks, Nevada. The responsible flight-test organization was the NASA Dryden Flight Research Center (DFRC), Edwards, California, which also provided the F/A-18 receiver airplane (McDonnell Douglas, now The Boeing Company, Chicago, Illinois). The B-707-300 tanker airplane (The Boeing Company) was contracted through Omega Aerial Refueling Services, Inc., Alexandria, Virginia, and the optical tracking system was contracted through OCTEC Ltd., Bracknell, Berkshire, UK. Nine research flights were flown, testing the functionality and performance of the system in a stepwise manner, culminating in the plug attempts on the final flight. Relative position keeping was found to be very stable and accurate. The receiver aircraft was capable of following the tanker aircraft through turns while maintaining its relative position. During the last flight, six capture attempts were made, two of which were successful. The four misses demonstrated excellent characteristics, the receiver retreating from the drogue in a controlled, safe, and predictable manner that precluded contact between the drogue and the receiver aircraft. The position of the receiver aircraft when engaged and in position for refueling was found to be 5.5 to 8.5 ft low of the ideal position. The controller inputs to the F/A-18 were found to be extremely small

Author

Air to Air Refueling; Autonomy; Flight Tests; Tanker Aircraft; Towed Bodies

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*.

20080003171 Naval Postgraduate School, Monterey, CA USA

Characterization, Optimization, and Test of the NPSAT1 MEMS 3-Axis Rate Sensor Suite for Use in Small Satellite Attitude Control

Pugsley, Thomas S; Sep 2007; 227 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474388; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The NPSAT1 project is a Naval Postgraduate School (NPS) educational small satellite combining student education in satellite systems and operations, institutional research, and sponsored experiments with the objective of testing technologies for applications in space flight. The micro-electro-mechanical system (MEMS) rate sensor is one of these experimental technologies. Packaging three of these MEMS sensors together makes a 3-axis rate sensor suite. The MEMS experiment was originally conceived of as a low-cost, low-mass augmentation to the magnetometer for use by the Attitude Control System (ACS). The experiment is to test the sensor suite's ability to measure NPSAT1 rates, comparing these rates to those determined by using a magnetometer and GPS. Operationally, the goal is to perform a space-flight demonstration of the MEMS sensor. This thesis includes two phases of research and development. First, the MEMS 3-axis rate sensor suite is fully tested and characterized. Experimental testing proves the sensor suite's effectiveness as a low-cost, low-mass augmentation to the magnetometer for satellite rate determination, as well as its ability to measure very low rates. Second, we adapt the original

design and operations to maximize the accuracy and utility of the sensor suite. Finally, a complete flight-like subsystem is built and tested.

DTIC

Attitude (Inclination); Attitude Control; Microelectromechanical Systems; Satellite Attitude Control

20080005322 Air Force Academy, CO USA

Harnessing the Heavens: National Defense through Space

White, Elwood L; Nov 2006; 32 pp.; In English

Report No.(s): AD-A474591; SPECIAL BIB SER-106; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This 'Special Bibliography Series,' Number 106, *Harnessing the Heavens: National Defense Through Space,' was developed by History Bibliographer and Reference Librarian Mr. Elwood L. White, in support of the 21st Triennial (previously biennial) Military History Symposium to be held at the Air Force Academy, 1-3 November 2006. This bibliography lists a selected portion of the McDermott (Cadet) Library's holdings on national defense through space. While it includes books and journal articles, it excludes newspaper articles and most pictorial works dealing with space defense. The call number listed at the end of each citation is typically the call number assigned by the Library of Congress, which most libraries use when adding books to their collections. The 10 sections of the bibliography are labeled as follows: I. Historical Background: The Strategic Defense Initiative, II. Historical Background: Other Aspects, III. Overviews of Military Space, IV. Weaponization of Space, V. Command and Control from Space, VI. Space Surveillance, VII. Satellite Navigation, VIII. Ballistic Missile Defense, IX. Space Forces and Space Operations, and X. Reference Works.

DTIC

Antimissile Defense; Command and Control; Defense Program; Space Weapons

20080006099 New Mexico Univ., Albuquerque, NM USA

Advanced Topics in Space Situational Awareness

Prasad, Sudhakar; Tyler, David; Nov 7, 2007; 24 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0107

Report No.(s): AD-A474997; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474997>

This report covers the technical accomplishments of the project entitled 'Advanced Concepts in Space Situational Awareness' over the period Feb 15, 2002 - June 30, 2007. The report contains a summary of the activities, accomplishments, and research/technology transitions of the project followed by their detailed technical description. Important original advances were made in the areas of information theoretic image assessment, algorithm development, spectral data mining, polarimetric imaging, and large-scale linear and nonlinear optimization methods. Applications of these advances to a number of areas of interest to the AF community are possible and some demonstrated, including the use of spectral data mining and polarimetric imaging for SOI, information-optimized imaging system design, computationally efficient and powerful processing methods for SSA data. A number of technology transitions that resulted attest to the success of the project, including information theoretic analysis for image evaluation, physically constrained image deconvolution (PCID) algorithms transitioned to MSSS, and spectral unmixing algorithms based on non-negative matrix and tensor factorization for rapid SOI.

DTIC

Algorithms; Emittance; Information Theory; Polarimetry; Situational Awareness; Spectra

20080006141 Industrial Coll. of the Armed Forces, Washington, DC USA

The Space Industry

Borrelli, Carmine; Buckon, Danielle; Cogossi, Bruce; Davidson, Cynthia; Ditzler-Smith, Cristie; Doddato, August; Gabrielson, Charles; Hubbard, Kenneth; Jacocks, Kent; Jircitano, Valerie; Jan 2007; 30 pp.; In English

Report No.(s): AD-A475093; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475093>

U.S. space domination is far from guaranteed as the number of space-faring nations increases. The U.S. space industry remains a critical element in providing capabilities essential to national security and economic prosperity. The ability to access space for communications, monitoring, research, and exploration is vital. To ensure these, U.S. policy should encourage more commercial activity in space, emphasize a more globally cooperative environment, change acquisition methods to emphasize

cost control over performance at any cost, and focus government investments on technologies having the greatest impact on the space industry.

DTIC

Aerospace Industry; Artificial Satellites; Astronautics; Industries

13 ASTRODYNAMICS

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

20080003333 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Radar Orbit Analysis Tool Using Least Squares Estimator

Rashash, Sandra M; Sep 2007; 100 pp.; In English

Report No.(s): AD-A474370; AFIT/GSS/ENY/07-S01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Most objects tracked in space follow a regular Keplerian orbit; unfortunately, non-Keplerian objects such as maneuvering satellites, tethered systems, and thrusting ballistic missiles are becoming more common. It is important to be able to distinguish between Keplerian and non-Keplerian objects due to the potential risk of a tethered satellite being mistaken for an object on re-entry. This research focused on creating a computer model that can detect the non-gravitational acceleration present in non-Keplerian orbits. A 3rd order Taylor series expansion was used to model the dynamics and to produce simulated radar data. Linear least squares estimation was used to estimate the initial state of a space object with a state vector composed of position, velocity, acceleration, and its first derivative. Monte Carlo analysis was used to verify that the estimator was unbiased and representative of the uncertainty in the data. The Monte Carlo method detected non-gravitational acceleration as small as 1.12 cm/sq s; however, a subsequent approach that analyzed the data sets individually only detected acceleration as small as 10.63 cm/sq s. At smaller magnitudes, the estimator was able to detect the presence of non-gravitational acceleration, but was ultimately unable to estimate the true value with statistical accuracy.

DTIC

Computerized Simulation; Estimates; Least Squares Method; Orbits

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*.

20080002961 Naval Postgraduate School, Monterey, CA USA

Smaller Satellite Operations Near Geostationary Orbit

Erdner, Matthew T; Sep 2007; 241 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473966; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473966>

With the ongoing miniaturization of components, the utility of smaller satellites is increasing. Many believe in the near future that small satellites will be able to perform all functions that larger satellites currently perform today. It has been suggested that these satellites will be less expensive, thus offer a lower risk to the consumer in case they fail before their mission design life. This paper looked at the ability to build and operate smaller satellites with current technology to perform covert Space Control and Space Situational Awareness missions near geostationary orbit. The investigation determined if space qualified Commercial Off The Shelf (COTS) components and current technology could be used to build covert smaller satellites. The largest satellite was sized to be undetectable from earth-based sensors. Subsequent CubeSat sizes were selected to determine how small a satellite could be built with COTS components and current technology to perform the assigned missions. A comparative analysis was then performed to determine how these satellites could be cost effectively launched to orbit. A cost estimate was performed to determine the entire life cycle cost for each satellite size excluding launch and integration segments. Using that information, the best satellite size was determined.

DTIC

Geosynchronous Orbits; Miniaturization; Satellite Orbits; Synchronous Satellites

20080003083 Boeing Co., Los Angeles, CA USA

Historical Review of Atomic Frequency Standards Used in Space Systems - 10 Year Update

Mallette, Leo A; Rochat, Pascal; White, Joseph; Jan 1, 2007; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A 1996 paper estimated 'that the total number of space-borne atomic frequency standards (AFS) is no more than several hundred' [1, p. 24]. The number of atomic frequency standards in space was dominated by the GPS, GLONASS, and Milstar satellite constellations. In this paper, we present an update to the historical review of the AFSs used in space systems. We will briefly review the systems existing in 1996, and add the newer systems (Galileo, GPS IIR and IIF, GLONASS-M, Cassini-Huygens, AEHF, and QZSS) and potential space systems (PARCS, PHARAO, Beidou) using atomic frequency standards. We have estimated that there have been a total of 452 atomic frequency standards launched into orbit for use on communications and scientific payloads. We conclude the paper with a review of the 1996 predictions for future AFSs and discuss the future as seen in 2006.

DTIC

Aerospace Systems; Atomic Clocks; Frequency Standards; Histories; Navigation Satellites

20080003090 National Inst. of Advanced Industrial Science and Technology, Ibaraki, Japan

Ground Experiments of Remote Synchronization for Onboard Crystal Oscillator of Quasi-Zenith Satellites - Use of Multiple Positioning Signals for Feedback Control

Iwata, Toshiaki; Imae, Michito; Suzuyama, Tomonari; Kawasaki, Yoshikatsu; Takasaki, Naoto; Kokubu, Kenji; Iwasaki, Akira; Fukushima, Satoshi; Hashibe, Yuji; Tappero, Fabrizio; Jan 2007; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have developed a new control method for the quasi-zenith satellite (QZS) remote synchronization system for the onboard crystal oscillator (RESSOX). The new method utilizes L1 and L2 positioning signals of the QZS system. We have proved that precise orbit prediction or estimation of delays such as those caused by the ionosphere and troposphere is not necessary to realize RESSOX technology. L1/L2/Ku-band signal delay caused by the ionosphere and other sources is calculated separately using RESSOX feedback control. The results of Ku-band delay are used to generate the appropriate control signal. The results show that synchronization within 2 ns between the ground-site atomic clock and the QZS site is achievable. We also confirmed that the crystal oscillator that has the same specifications as the actual onboard crystal oscillator could be controlled by the same method as the prototype in the test bed.

DTIC

Artificial Satellites; Crystal Oscillators; Feedback Control; Positioning; Remote Control; Synchronism; Zenith

20080003364 Naval Postgraduate School, Monterey, CA USA

Ground Segment Preparation for NPSAT1

Koerschner, Luke; Sep 2007; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474030>

Most satellites rely on a ground control station to command their payloads and through which they download data from their payloads. The Naval Postgraduate School's satellite (NPSAT1) is no exception. The spacecraft's payloads, which include the Coherent Electromagnetic Radio Tomography (CERTO), Langmuir probe, Configurable Fault Tolerant Processor (CFTP), as well as the Visible Wavelength Imager (VISIM), all generate data that require collection on the ground through a radio frequency downlink. Telemetry from NPSAT1's unique attitude control system, which uses only MEMS angular rate sensors, magnetic coils, a magnetometer and a GPS could aid in the development of improved or more economical attitude control systems. The goal of this thesis is to ready the ground control segment for operation for collection of data from and command of NPSAT1 immediately after launch. Included is a description of the spacecraft to ground calculation, bidirectional, link budget and the operation and testing of the ground antenna pointing control system. Future space systems students and faculty will use the ground control segment to harvest the data and reap the knowledge of the experiments that will orbit inside NPSAT1. What better way to test the pointing of the antenna than to use it to track the Midshipman Space Technology Applications Research Program's first satellite (MidSTAR1).

DTIC

Military Spacecraft; Navy; Ground Stations

20080005230 Naval Postgraduate School, Monterey, CA USA

Modeling of Operating Temperature Performance of Triple Junction Solar Cells Using Silvaco's ATLAS

Sanders, Michael H; Sep 2007; 123 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The inefficiency of solar cells due to high operating temperatures presents a growing issue for the spacecraft industry. Currently, the problem is solved by accepting the manufactured designs and compensating for losses with larger solar arrays. Building upon prior thesis work at the Naval Postgraduate School, this thesis utilizes Silvaco's ATLAS software as a tool to simulate the performance of a typical InGaP/GaAs/Ge multi-junction solar cell at various temperatures. Additional optimization is performed on the base thickness layers to represent that enhancement for the proper operating environment can be achieved. Results are shown for a multi-junction cell operating under Air Mass 0 at 300K, 325K, 350K, and 375K.

DTIC

Operating Temperature; Panels; Performance Prediction; Solar Cells

20080005244 Trex Enterprises Coup., Lihue, HI USA

Chemical Vapor Composite Silicon Carbide for Space Telescopes (postprint)

Tanaka, Clifford T; Webb, Kyle; Sep 18, 2006; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9451-05-C-0019; Proj-3005

Report No.(s): AD-A474535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this figure study was to demonstrate the optical figure and opto-mechanical performance capabilities for Trex's CVC SiC material. In the course of this activity a plano mirror was designed, fabricated, polished, and analyzed using interferometry tools and methods. The opto-mechanical and interferometric performance results are presented and analyzed in this report.

DTIC

Ceramic Matrix Composites; Chemical Composition; Silicon Carbides; Spaceborne Telescopes; Telescopes; Vapors

20080005254 Minnesota Univ., Minneapolis, MN USA

An Integrated Design Methodology for Nanosat Navigation Guidance and Control Systems

Gebre-Egziabher, Demoz; Aug 14, 2007; 18 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0327

Report No.(s): AD-A474558; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474558>

Minnesat is the micro-satellite that was designed by the University of Minnesota as part of UNP-4. The mission of Minnesat was to validate the use carrier phase GPS technology to mechanize a compact and accurate attitude determination system. In a broader sense, the objective of this work was to also demonstrate a design methodology for miniature spacecraft navigation, guidance and control systems which integrate the vehicle design process with that of the process of designing the avionics. Minnesat was presented to the US Air Force at the UNP-4 flight competition review. Although Minnesat was not the winning design, it accomplished its scientific and educational goals. The research work of designing compact GPS attitude determination systems continues at the University of Minnesota building on the success of Minnesat. On the other hand, students that were participants in the UNP-4 competition are now employed by various aerospace corporations, are enrolled in aerospace engineering graduate programs or are completing advanced degrees in engineering and science programs.

DTIC

Artificial Satellites; Attitude (Inclination); Global Positioning System; Guidance (Motion); Microsatellites; Miniaturization; Nanosatellites; Navigation

20080005255 Texas A&M Univ., College Station, TX USA

AGGIESAT 1

Reed, Helen L; Mar 31, 2007; 13 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0350; Proj-2305

Report No.(s): AD-A474559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474559>

The purpose of this final report is to provide a summary of the University Nanosat 4 Program's AggieSatI. Nanosat 4 was a joint program among AFOSR, AIAA, NASA GSFC, and AFRL/VS. The objectives of the program were to educate and train the future workforce through a national student satellite design and fabrication competition, and to enable small satellite R&D,

payload development, integration, and flight test. Nanosat 4 had two distinct stages. The first part was a design and build phase involving 11 Universities, which lasted two years and culminated in the AIAA Student Satellite Flight Competition in March 2007. The competition winner was to be integrated with the AFRL Internal Cargo Unit (ICU) for flight on the Space Shuttle. The second part consists of construction and test of the flight unit and culminates in launch of the Nanosat. The selected Nanosat from Cornell is expected to be flight-ready by September 2007.

DTIC

Artificial Satellites; Miniaturization; Nanosatellites; Systems Engineering

20080005340 New Mexico State Univ., Las Cruces, NM USA

NMSUSat2

Horan, Stephen; Mar 31, 2007; 24 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0267

Report No.(s): AD-A474621; NMSU-ECE-07-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The students, faculty, and staff from New Mexico State University (NMSU) have completed their development of a nanosatellite called the Second NMSUSAT (NMSUSat2) as part of the University Nanosatellite Program. The satellite components have been finalized 2006-2007 academic year. This report captures the final design details the involvement of students in the program. This program is also being used as a model program for structuring capstone design classes in the Electrical and Computer Engineering program at NMSU. Over the project, a total of 58 students were actively involved in this program including 12 pre-freshman or high school students.

DTIC

Artificial Satellites; Nanosatellites; Robotics; Students

20080005349 Library of Congress, Washington, DC USA

U.S. Civilian Space Policy Priorities: Reflections 50 Years After Sputnik

Stine, Deborah D; Dec 3, 2007; 31 pp.; In English

Report No.(s): AD-A474660; CRS-RL34263; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The 'space age' began on October 4, 1957, when the Soviet Union (USSR) launched Sputnik, the world's first artificial satellite. Some U.S. policymakers, concerned about the USSR's ability to launch a satellite, thought Sputnik might be an indication that the USA was trailing behind the USSR in science and technology. The Cold War also led some U.S. policymakers to perceive the Sputnik launch as a possible precursor to nuclear attack. In response to this Sputnik moment, the U.S. government undertook several policy actions, including the establishment of the National Aeronautics and Space Administration (NASA) and the Defense Advanced Research Projects Agency (DARPA), enhancement of research funding, and reformation of science, technology, engineering and mathematics (STEM) education policy. Following the Sputnik moment, a set of fundamental factors gave importance, urgency, and inevitability to the advancement of space technology, according to an Eisenhower presidential committee. These four factors include the compelling need to explore and discover; national defense; prestige and confidence in the U.S. scientific, technological, industrial, and military systems; and scientific observation and experimentation to add to our knowledge and understanding of the Earth, solar system, and universe. They are still part of current policy discussions and influence the nation's civilian space policy priorities both in terms of what actions NASA is authorized to undertake and the appropriations each activity within NASA receives. NASA has active programs that address all four factors, but many believe that it is being asked to accomplish too much for the available resources.

DTIC

Artificial Satellites; Space Law; Sputnik Satellites

20080005391 Aerospace Corp., El Segundo, CA USA

Tribochemistry of Multiply-Alkylated Cyclopentane Oils on DLC-Coated Thrust Bearings

Lince, Jeffrey R; Bertrand, Patricia A; Nov 15, 2007; 28 pp.; In English

Contract(s)/Grant(s): FA8802-04-C-0001; W31-109-ENG-38

Report No.(s): AD-A474735; TR-2007(8565)-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In contrast to typical DLC coatings, hydrogenated DLC (H-DLC) coatings exhibit extremely low friction in vacuum and dry atmospheres, suggesting their potential importance for spacecraft applications. We have conducted a study of H-DLC-coated steel thrust bearings, lubricated with a multiply-alkylated cyclopentane oil, either unformulated, or formulated with lead naphthenate or an aryl phosphate ester mixture. Data on uncoated steel thrust bearings were obtained for comparison.

The surface chemistry of the additives on worn H-DLC surfaces was evaluated along with chemical analysis of the residual lubricant. In contrast with results on uncoated steel bearings, minimal additive-based tribofilm formation was detected on the surfaces of the H-DLC coatings in the wear tracks. The results indicate that additives optimized for steels may not be appropriate for H-DLC coatings. Although there were indications that H-DLC coatings increase endurance, the high roughness of the bearings contributed to statistical uncertainty. Future studies are planned with higher quality bearings.

DTIC

Alkylation; Coatings; Cyclic Hydrocarbons; Oils; Pentanes; Thrust Bearings

20080005669 Aerospace Corp., El Segundo, CA USA

Pico Satellite Solar Cell Testbed (PSSC Testbed)

Simburger, E J; Liu, S; Halpine, J S; Hinkley, D A; Rumsey, D L; Granata, J E; Yoo, H; Sep 25, 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A474819; TR-2007-1210-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The PSSC Testbed flight experiment is designed to obtain space environment degradation data for advanced solar cells. The purpose of this particular experiment is to develop and operationally test the picosatellite and associated ground station. This picosat could be the starting point for the development of a responsive space vehicle that would provide the capability of obtaining actual space environment exposure of new solar cell technology in a time frame that is in sync with the new-generation solar cell's introduction cycle. Presently, there are two missions to be flown. The first mission has been manifested to fly on a Shuttle flight in mid 2008. The second mission will be a secondary payload on an EELV launch of a Geo payload. The PSSC Testbed will be inserted into a Geo Transfer orbit. This orbit will fly through the Van Allen Radiation Belts, resulting in an accelerated deposition of radiation when compared to LEO or GEO orbits. The equivalent of 15 years of radiation exposure that would be accumulated in a GEO orbit will be deposited on the solar cells in 300 days.

DTIC

Aerospace Environments; Artificial Satellites; Environment Effects; Solar Cells; Test Stands

20080005697 Naval Research Lab., Washington, DC USA

Multiple Quantum Well-Based Modulating Retroreflectors for Inter- and Intra-Spacecraft Communications

Goetz, Peter G; Rabinovich, William S; Gilbreath, G C; Mahon, Rita; Ferraro, Mike S; Swingen, Lee; Walters, Robert J; Messenger, Scott R; Wasiczko, Linda M; Murphy, James; Jan 2006; 12 pp.; In English

Report No.(s): AD-A474891; NRL-06-1226-2171; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Free space optics 'FSO' can provide high data rates with efficient use of power. However, small platforms may not be able to support the payload requirements of a conventional FSO terminal. An alternative FSO terminal uses a modulating retro-reflector 'MRR'. MRRs shift most of the power, weight, and pointing requirements to one end of the link. With a MRR configuration, it is possible to establish a two-way FSO link using a single laser transmitter. The MRR terminal of these systems can be small, lightweight, and low power. The MRR maintains the small beam divergence of a conventional optical communications link, but gains the loose pointing advantage of an RF link, reducing the pointing requirements. Communication needs in space present many asymmetric scenarios in which a MRR architecture could be beneficial. This paper describes some of the current capabilities and limitations of MRR systems, as well as applications to space links. An evaluation of the radiation tolerance of modulators is presented.

DTIC

Aerospace Systems; Modulation; Optical Communication; Quantum Wells; Retroreflectors; Spacecraft Communication; Telecommunication

20080005831 Air War Coll., Maxwell AFB, AL USA

Improving Satellite Protection with Nanotechnology

Huntington, Joseph; Dec 2007; 23 pp.; In English

Report No.(s): AD-A474825; No Copyright; Avail.: Defense Technical Information Center (DTIC)

While the USA has enjoyed an historic advantage in space and the U.S. Air Force (USAF) has enjoyed the luxury of operating relatively unimpeded in this medium, the nation has become vulnerable to threats that could damage or disable its vital satellite constellations. This paper examines the threat to satellites posed by ground-based directed energy weapons and the state of satellite-related nanotechnology research and development (R&D) to demonstrate the applicability for mitigating this type of threat. The paper argues that USAF leaders need to make continued R&D into nanotechnology for satellite

applications an investment priority. This will require a long and expensive commitment, only some of which will pay off, but it is necessary if the USAF and the nation are to maintain space supremacy. The paper begins by describing the threat to U.S. satellites posed by directed energy weapons. The paper specifically examines both lasers and high-powered microwaves, describing what they are and how they may threaten satellites. It then discusses what countries currently possess these capabilities and what capability adversaries might possess in the 2025 timeframe. From these discussions, the paper draws upon common satellite orbits to show the role orbits play in satellite vulnerability. It also looks at common satellite subsystems and explores how ground-based directed energy weapons could damage these systems. Several definitions for nanotechnology are explored. The paper explains how nanomaterials are different from materials at the micro- or macro-scale, and details the different properties nanomaterials possess. The paper then explains how the work from nanotechnology R&D projects can be applied to satellite subsystems, for example, surface coatings that could be used to improve satellite thermal control and electrical conductivity, and nanomaterials to improve the radiation hardness of satellite microprocessors and other structures.

DTIC

Nanotechnology; Protection; Satellite Constellations; Satellite Design; Systems Engineering; Vulnerability; Weapon Systems

20080006073 Library of Congress, Washington, DC USA

China's Space Program: Options for U.S.-China Cooperation

Logan, Jeffrey; Dec 14, 2007; 7 pp.; In English

Report No.(s): AD-A474952; CRS-RS22777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474952>

China has a determined, yet still modest, program of civilian space activities planned for the next decade. The potential for U.S.-China cooperation in space -- an issue of interest to Congress -- has become more controversial since the January 2007 Chinese anti-satellite test. The test reinforced concerns about Chinese intentions in outer space and jeopardized space assets of more than two dozen countries by creating a large cloud of orbital space debris. Some argue that Chinese capabilities now threaten U.S. space assets in low earth orbit. Others stress the need to expand dialogue with China. This report outlines recent activities and future plans in China's civilian space sector. It also discusses benefits and trade-offs of possible U.S.-China collaboration in space, as well as several options to improve space relations, including information exchange, policy dialogue, and joint activities. Following an introduction, sections discuss China's Human Space Flight Program; China's Lunar Exploration Activities; and U.S.-China Space Cooperation, including the Challenges of Cooperating with China, the Benefits of Cooperating with China, and Options for Possible Cooperation. For more information, see CRS Report RS21641, 'China's Space Program: An Overview.' This report will not be updated.

DTIC

Aerospace Engineering; China; United States

20080006345 Cincinnati Univ., OH USA

Nanosatellite Demonstration of Multi-Functional Space Systems

Williams, Trevor W; Mar 31, 2007; 33 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0386; Proj-2301/DX

Report No.(s): AD-A475277; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effort under this grant was designed to further the goals of both NASA and the Air Force in the area of small satellites in two ways: hardware development for nanosatellites, and the education of future aerospace professionals. The hardware component of the effort involved the design, construction and testing of a flight-ready nanosatellite to demonstrate several novel technologies for small satellites. The five on-board experiments, the details of which are given below, had as their emphasis the use of hardware that is capable of performing several distinct satellite functions, or is based on commercial off-the-shelf (COTS) technologies, or both. Multi-functionality and COTS systems are key to the development of low-mass, low-volume, low-cost nanosatellites. The educational component of the grant involved teams of aerospace engineering, electrical engineering and computer science undergraduates designing, developing and testing BEARSat, as well as individual graduate students, two of whom serve in succession as Project Manager. As a result of this effort, NASA and the Air Force have additional young aerospace engineers available with practical experience in nanosatellite technology.

DTIC

Aerospace Systems; Nanosatellites; Nanotechnology; Scientific Satellites; Spacecraft Components; Students

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*.

20080006064 NASA Glenn Research Center, Cleveland, OH, USA

Development of Network-based Communications Architectures for Future NASA Missions

Slywczak, Richard A.; November 26, 2007; 11 pp.; In English; Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC) 2007, 26-29 Nov. 2007, Orlando, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 439432.04.18.01

Report No.(s): Paper No. 7323; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006064>

Since the Vision for Space Exploration (VSE) announcement, NASA has been developing a communications infrastructure that combines existing terrestrial techniques with newer concepts and capabilities. The overall goal is to develop a flexible, modular, and extensible architecture that leverages and enhances terrestrial networking technologies that can either be directly applied or modified for the space regime. In addition, where existing technologies leaves gaps, new technologies must be developed. An example includes dynamic routing that accounts for constrained power and bandwidth environments. Using these enhanced technologies, NASA can develop nodes that provide characteristics, such as routing, store and forward, and access-on-demand capabilities. But with the development of the new infrastructure, challenges and obstacles will arise. The current communications infrastructure has been developed on a mission-by-mission basis rather than an end-to-end approach; this has led to a greater ground infrastructure, but has not encouraged communications between space-based assets. This alone provides one of the key challenges that NASA must encounter. With the development of the new Crew Exploration Vehicle (CEV), NASA has the opportunity to provide an integration path for the new vehicles and provide standards for their development. Some of the newer capabilities these vehicles could include are routing, security, and Software Defined Radios (SDRs). To meet these needs, the NASA/Glenn Research Center's (GRC) Network Emulation Laboratory (NEL) has been using both simulation and emulation to study and evaluate these architectures. These techniques provide options to NASA that directly impact architecture development. This paper identifies components of the infrastructure that play a pivotal role in the new NASA architecture, develops a scheme using simulation and emulation for testing these architectures and demonstrates how NASA can strengthen the new infrastructure by implementing these concepts.

Author

Radio Equipment; Space Exploration; Communication Networks; NASA Programs; Bandwidth

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*.

20080005204 NASA Johnson Space Center, Houston, TX, USA

The Columbia Debris Loan Program; Examples of Microscopic Analysis

Russell, Rick; Thurston, Scott; Smith, Stephen; Marder, Arnold; Steckel, Gary; July 30, 2006; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Following the tragic loss of the Space Shuttle Columbia NASA formed The Columbia Recovery Office (CRO). The CRO was initially formed at the Johnson Space Center after the conclusion of recovery operations on May 1, 2003 and then transferred to the Kennedy Space Center on October 6, 2003 and renamed The Columbia Recovery Office and Preservation. An integral part of the preservation project was the development of a process to loan Columbia debris to qualified researchers and technical educators. The purposes of this program include aiding in the advancement of advanced spacecraft design and flight safety development, the advancement of the study of hypersonic re-entry to enhance ground safety, to train and instruct accident investigators and to establish an enduring legacy for Space Shuttle Columbia and her crew. Along with a summary of the debris loan process examples of microscopic analysis of Columbia debris items will be presented. The first example will be from the reconstruction following the STS- 107 accident and how the Materials and Pro~es~teesa m used microscopic

analysis to confirm the accident scenario. Additionally, three examples of microstructural results from the debris loan process from NASA internal, academia and private industry will be presented.

Author

Flight Safety; Space Shuttles; Spacecraft Design; Debris; Losses; Space Transportation System

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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*.

20060044137

Results of a 2000 hour wear test of the NEXIS ion engine

Snyder, John Steven; Goebel, Dan M.; Polk, James E.; Schneider, Analyn C; Sengupta, Anita; October 31, 2005; In English; 29th International Electric Propulsion Conference, Princeton University, October 31 - November 4, 2005, Princeton, NJ, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/39358>

The Nuclear Electric Xenon Ion System (NEXIS) ion thruster was developed for potential outer planet robotic missions under NASA's Prometheus program. This engine was designed to operate at power levels ranging from 16 to over 20 kWe at specific impulses of 6000 to 7500 s for burn times of up to 10 years, satisfying the requirements of nuclear electric propulsion systems such as that on the proposed Prometheus 1 mission to explore the icy moons of Jupiter. State-of-the-art performance and life assessment tools were used to design the thruster. Following the successful performance validation of a Laboratory Model thruster, Development Model hardware was fabricated and subjected to vibration and wear testing. The results of a 2000-hour wear test are reported herein. Thruster performance achieved the target requirements and was steady for the duration of the test. Ion optics performance was similarly stable. Discharge loss increases of 6 eV/ion were observed in the first 500 hours of the test and were attributed to primary electron energy decreases due to cathode insert conditioning. Relatively high recycle rates were observed and were identified to be high-voltage-to-ground arcs in the back of the thruster caused by wire insulation outgassing and electron penetration through the plasma screen. Field emission of electrons between the accelerator and screen grids was observed and attributed to evolution of field emitter sites at accelerator grid aperture edges caused by ion bombardment. Preliminary modeling and analysis indicates that the NEXIS engine can meet mission performance requirements over the required lifetime. Finally, successful validation of the NEXIS design methodology, design tools, and technologies with the results of the wear test and companion performance and vibration tests presents significant applicability of the NEXIS development effort to missions of near-term as well as long-term interest for NASA.

Author

Apertures; Cathodes; Edges; Electron Energy; Electrons; Emitters; Fabrication; Field Emission; Grand Tours; High Voltages; Insulation; Ion Engines; Ion Irradiation; Ion Optics; Losses; Mission Planning; Outgassing; Performance Tests; Plasmas (Physics); Prometheus; Propulsion System Configurations; Propulsion System Performance; Robotics; Specific Impulse; Vibration; Vibration Tests; Wear; Wear Tests; Xenon

20080002929 Royal Aircraft Establishment, Farnborough, UK

Propellant Feed Valves for Starting and Control of Rocket Motors

Schoenheit, W; Aug 1951; 18 pp.; In English

Report No.(s): AD-A473903; RAE-TN-RPD-53; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473903>

The type of valve described in this note has been designed to use the pressure in the feed system between the valve and the injector as the controlling medium. This allows automatic control of the valve and safe starting and operation of the rocket motor to be obtained with greater simplicity than in other types of valve hitherto known which are intended to fulfill the same purpose; the new valves also permit the use of a timing sequence for propellant control to be dispensed with. The principle of operation and the types already developed are described in full, with suggestions for further applications.

DTIC

Control Rockets; Propellants; Rocket Engines; Valves

20080002977 Ministry of Supply, London, UK

The Assessment of Liquid Propellant Injectors. Part 2. The Measurement of Droplet Size Distribution by Direct Photography With Microflash Illumination

Adams, G K; Apr 1949; 25 pp.; In English

Report No.(s): AD-A474008; ERDE-31/R/48; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474008>

Object of investigation: To explore the usefulness of direct photography in the measurement of droplet size distribution in sprays from liquid propellant injectors. Scope of Investigation: An apparatus for the low power photomicrography of sprays with spark illumination has been set up, and a technique developed for the measurement and counting of the droplet images. The optimum conditions and possible accuracy of the measurement of the distribution of droplet sizes within the spray have been investigated. The results obtained with several types of injector are given in illustration of the method. Conclusions: The use of direct photography for the assessment of injector sprays has great advantages in flexibility of application to varying types of injector and conditions of operation. It is the only method which can give information on the incipient state of atomization close to the orifice and under conditions other than those in the free atmospheres. The instantaneous character and the limited volume of the sampling are disadvantages when the average distributions over a large spray volume are required. A measuring and counting technique is described which reduces to a minimum the time and labor consumed in measuring up a large number of photographs.

DTIC

Drop Size; Injectors; Liquid Rocket Propellants; Photography; Size Distribution

20080003022 Royal Aircraft Establishment, Farnborough, UK

The Cartridge-Operated Propellant Feed System for the R.T.V.I Rocket Motor

Bond, W H; Merrington, A C; May 1950; 44 pp.; In English

Report No.(s): AD-A474094; RAE-TN-RPD-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474094>

No abstract available

Cartridges; Feed Systems; Propellants; Rocket Engines

20080003025 Explosives Research and Development Establishment, Waltham Abbey, UK

Technical Report for the Period 1 January 1964 to 30 June 1964

Aug 24, 1964; 75 pp.; In English

Report No.(s): AD-A474110; ERDE-TR-1/64; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474110>

No abstract available

Liquid Rocket Propellants; Solid Rocket Propellants

20080003036 Royal Aircraft Establishment, Farnborough, UK

Report on Visit to Establishments in the USA Dealing With Liquid Propellant Rocket Motors, April-May, 1950

Broughton, L W; Newman, L W; Wiseman, L A; Sep 1950; 51 pp.; In English

Report No.(s): AD-A474143; RAE-TN-RPD-39; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474143>

No abstract available

Liquid Propellant Rocket Engines; United States

20080003139 Royal Aircraft Establishment, Farnborough, UK

Nitric Acid - Kerosene Rocket Motors: Initial Development Work With Impinging Jet Type Injectors

Hagerty, R P; Meier, K; Wheeler, W E; Frauenberger, J H; Apr 1952; 46 pp.; In English

Report No.(s): AD-A474327; RAE-TN-RPD-65; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Injectors; Jet Impingement; Kerosene; Nitric Acid; Rocket Engines

20080003784 Royal Aircraft Establishment, Farnborough, UK

Penalties Incurred in Using Rocket Motors over a Wide Temperature Range

Goyer, M; Jan 1951; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474137; RAE-TN-RPD-44; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474137>

No abstract available

Rocket Engines; Solid Propellant Rocket Engines; Liquid Propellant Rocket Engines

20080003786 Royal Aircraft Establishment, Farnborough, UK

Development of 7.5-inch Booster Motor

Litton, J C; Crook, J H; May 1952; 54 pp.; In English

Report No.(s): AD-A474093; RAE-TN-RPD-67; RAE-TR-ADE-2/52; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474093>

No abstract available

Booster Rocket Engines; Burners

20080003866 NASA Glenn Research Center, Cleveland, OH, USA

Realistic Specific Power Expectations for Advanced Radioisotope Power Systems

Mason, Lee S.; June 26, 2006; 7 pp.; In English; 4th International Energy Conversion Engineering Conference (IECEC-2006), 26-29 Jun. 2006, San Diego, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 463169.01.03; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003866>

Radioisotope Power Systems (RPS) are being considered for a wide range of future NASA space science and exploration missions. Generally, RPS offer the advantages of high reliability, long life, and predictable power production regardless of operating environment. Previous RPS, in the form of Radioisotope Thermoelectric Generators (RTG), have been used successfully on many NASA missions including Apollo, Viking, Voyager, and Galileo. NASA is currently evaluating design options for the next generation of RPS. Of particular interest is the use of advanced, higher efficiency power conversion to replace the previous thermoelectric devices. Higher efficiency reduces the quantity of radioisotope fuel and potentially improves the RPS specific power (watts per kilogram). Power conversion options include Segmented Thermoelectric (STE), Stirling, Brayton, and Thermophotovoltaic (TPV). This paper offers an analysis of the advanced 100 watt-class RPS options and provides credible projections for specific power. Based on the analysis presented, RPS specific power values greater than 10 W/kg appear unlikely.

Author

Radioisotope Batteries; Spacecraft Power Supplies; Radioisotope Heat Sources; Thermoelectric Power Generation

20080003887 NASA Glenn Research Center, Cleveland, OH, USA

Progress in Technology Validation of the Next Ion Propulsion System

Benson, Scott W.; Patterson, Michael J.; May 14, 2007; 15 pp.; In English; 54th JANNAP Propulsion Meeting, May 2007, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 346620.04.05.03.11; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003887>

The NASA's Evolutionary Xenon Thruster (NEXT) ion propulsion system has been in advanced technology development under the NASA In-Space Propulsion Technology project. The highest fidelity hardware planned has now been completed by the government/industry team, including a flight prototype model (PM) thruster, an engineering model (EM) power processing unit, EM propellant management assemblies, a breadboard gimbal, and control unit simulators. Subsystem and system level technology validation testing is in progress. To achieve the objective Technology Readiness Level 6, environmental testing is being conducted to qualification levels in ground facilities simulating the space environment. Additional tests have been conducted to characterize the performance range and life capability of the NEXT thruster. This paper presents the status and results of technology validation testing accomplished to date, the validated subsystem and system capabilities, and the plans for completion of this phase of NEXT development.

Author

Ion Propulsion; Xenon; Thrusters; Technology Utilization; Fabrication; Systems Integration; NASA Programs

20080003888 NASA Glenn Research Center, Cleveland, OH, USA

Technology Readiness of the NEXT Ion Propulsion System

Benson, Scott W.; Patterson, Michael J.; [2008]; 10 pp.; In English; IEEE Aerospace Conference, 1-8 Mar. 2008, Big Sky, MT, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 346620.04.05.03.11

Report No.(s): IEEEAC-2008-1479; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003888>

The NASA's Evolutionary Xenon Thruster (NEXT) ion propulsion system has been in advanced technology development under the NASA In-Space Propulsion Technology project. The highest fidelity hardware planned has now been completed by the government/industry team, including: a flight prototype model (PM) thruster, an engineering model (EM) power processing unit, EM propellant management assemblies, a breadboard gimbal, and control unit simulators. Subsystem and system level technology validation testing is in progress. To achieve the objective Technology Readiness Level 6, environmental testing is being conducted to qualification levels in ground facilities simulating the space environment. Additional tests have been conducted to characterize the performance range and life capability of the NEXT thruster. This paper presents the status and results of technology validation testing accomplished to date, the validated subsystem and system capabilities, and the plans for completion of this phase of NEXT development. The next round of competed planetary science mission announcements of opportunity, and directed mission decisions, are anticipated to occur in 2008 and 2009. Progress to date, and the success of on-going technology validation, indicate that the NEXT ion propulsion system will be a primary candidate for mission consideration in these upcoming opportunities.

Author

Ion Propulsion; Propulsion System Configurations; Propulsion System Performance; Technology Assessment; Systems Engineering; Ion Engines; Aerospace Environments; Propellants

20080005554 NASA Glenn Research Center, Cleveland, OH, USA

NASA 9-Point LDI Code Validation Experiment

Hicks, Yolanda R.; Anderson, Robert C.; Locke, Randy J.; October 30, 2007; 28 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

This presentation highlights the experimental work to date to obtain validation data using a 9-point lean direct injector (LDI) in support of the National Combustion Code. The LDI is designed to supply fuel lean, Jet-A and air directly into the combustor such that the liquid fuel atomizes and mixes rapidly to produce short flame zones and produce low levels of oxides of nitrogen and CO. We present NO_x and CO emission results from gas sample data that support that aspect of the design concept. We describe this injector and show high speed movies of selected operating points. We present image-based species maps of OH, fuel, CH and NO obtained using planar laser induced fluorescence and chemiluminescence. We also present preliminary 2-component, axial and vertical, velocity vectors of the air flow obtained using particle image velocimetry and of the fuel drops in a combusting case. For the same combusting case, we show preliminary 3-component velocity vectors obtained using a phase Doppler anemometer. For the fueled, combusting cases especially, we found optical density is a technical concern that must be addressed, but that in general, these preliminary results are promising. All optical-based results confirm that this injector produces short flames, typically on the order of 5- to-7-mm long at typical cruise and high power engine cycle conditions.

Author

Injectors; Liquid Fuels; Flow Velocity; Combustion Chambers; Air Flow; Nitrogen Oxides; Atomizing; Image Analysis; Combustion

20080006053 NASA Marshall Space Flight Center, Huntsville, AL, USA

Progress on the PT-1 Prototype Plasmoid Thruster

Esckridge, Richard H.; Martin, Adam K.; October 17, 2007; 13 pp.; In English; AFRL Space Power and Propulsion Workshop, 17-19 Oct. 2007, Huntsville, AL, USA; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006053>

The design and construction of a plasmoid thruster prototype is described. This thruster operates by expelling inductively formed plasmoids at high velocities. These plasmoids are field reversed configuration plasmas which are formed by reversing a magnetic flux frozen in an ionized gas inside a theta-pinch coil. The pinch coil is a unique multi-turn, multi-lead design chosen for optimization of inductance and field uniformity. A table-top bread-board demonstrator has been built at MSFC, and

will be delivered to Radiance Technologies Inc. for further testing at the Auburn Space Power Institute.

Author

Plasmas (Physics); Design Optimization; Inductance; Breadboard Models; Magnetic Flux; Ionized Gases; Thrustors

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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*.

20080002940 Air Force Research Lab., Wright-Patterson AFB, OH USA

A New Type of Potassium Niobate Crystal: Utilizing the Potassium Sites (Preprint)

Evans, Dean R.; Jan 2006; 18 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473932; AFRL-ML-WP-TP-2007-498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473932>

Darker regions (perturbed Fe- FeNb near a AgK) in the crystal exhibit strong contra-directional-TBC. There is a similar affect for interchanging NiNb for FeNb and RbK for AgK. AuK should work as well, but there's no evidence yet. The presence of Ag changes the local environment, perturbing the other impurities (i.e. Oh-), and the phonon/Raman modes are strongly affected. Ag was then purposely used as a codopant KNbO₃:Fe, Ag and is responsible for: An enhanced visible/OH-absorption. A stronger PV field. The strong affect on the Raman scatter. A possible increase in trap density (undetermined). Codoping with Ag is better than Rb in terms of speed, there's no significant difference in AOD. Singly doped Ag and unperturbed Fe are hole conducting, whereas perturbed Fe is electron conducting.

DTIC

Crystals; Niobates; Potassium; Potassium Compounds

20080002954 Universal Energy Systems, Inc., Dayton, OH USA

Platinum Acetylide Two-Photon Chromophores (Postprint)

Fleitz, Paul A; Cooper, Thomas M; Rogers, Joy E; Slagle, Jonathan E; Burke, Aaron R; Krein, Douglas M; Hall, Benjamin C; Fratini, Albert; McLean, Daniel G; Jan 2007; 16 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473956; AFRL-ML-WP-TP-2007-544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473956>

To explore the photophysics of platinum acetylide chromophores having strong two-photon absorption cross-sections, we have investigated the synthesis and spectroscopic characterization of a series of platinum acetylide complexes that feature highly π -conjugated ligands substituted with π -donor or π -acceptor moieties. The molecules (numbered 1-4) considered in the present work are NLO-functionalized analogs of bis(phenylethynyl)bis(bributylphosphine)platinum(II) complexes. Molecule 1 carries two benzothiazolylfluorene and molecule 2 carries two diphenylamino fluorene substituents bound to the central platinum atom. Compounds 3 and 4 possess two dihexylaminophenyl substituents at their ends and differ by the number of platinum atoms in the oligomer "core" (one vs. two in 3 and 4, respectively). The conjugated ligands impart the complexes with effective two-photon absorption cross sections, while the heavy metal platinum centers give rise to efficient intersystem crossing to afford long lived triplet states. Photophysical studies demonstrate that one-photon excitation of the chromophores produces and S₁ state that is delocalized across the two conjugated ligands, with weak (excitonic) coupling through the platinum center(s). The S₁ state is observed by ultrafast transient absorption and by its characteristic fluorescence. Intersystem crossing occurs rapidly ($k_{isc} \approx 10^{11} \text{ s}^{-1}$) to produce the T₁ state, which is believed to be localized on a single conjugated fluorenyl ligand. The triplet state is strongly absorbing ($E_{TT} > 5 \times 10^4 \text{ M}^{-1}\text{cm}^{-1}$) and it is very long-lived ($\tau > 100 \mu\text{s}$). Femtosecond pulses were used to characterize the two-photon absorption properties of the complexes, and all of the chromophores are relatively efficient two photon absorbers in the visible and near-infrared region of the spectrum (600 - 800 nm). The complexes ex

DTIC

Chromophores; Photons; Platinum

20080002956 Air Force Research Lab., Wright-Patterson AFB, OH USA

Comparison of Matrix Cracking in High Temperature and Lower Temperature PMCs from Cryogenic Exposure (Preprint)

Bechel, Vernon T; Mar 2007; 11 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A473959; AFRL-ML-WP-TP-2007-481; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473959>

The behavior of a high temperature carbon/polyimide composite, T650/AFR-PE-4, in a cryogenic environment was studied. The results were compared to results from similar testing of a carbon/epoxy and a carbon/bismaleimide composite to begin to scale the difficulties involved with using high temperature polymer matrix composites (PMCs) in cryogen containers on launch vehicles. T650/AFR-PE-4 developed transverse cracks in all plies after fewer cycles than the carbon/bismaleimide (IM7/5250-4) when each was cycled between -196-C and their respective maximum service temperatures. While a change to a cross-ply of IM7/5250-4 showed a substantial reduction in the tendency toward a complete crack network in past work on IM7/5250-4, there was only a small delay of 50 cycles in the formation of transverse cracks in all plies when a [0/90]2S lay-up of T650/AFR-PE-4 was used instead of a [0/45/-45/90]S lay-up. On the other hand, the lay-up change corresponded to a large permeability reduction indicating that either the amount of delamination was much lower in the [0/90]2S samples after thermal cycling or the cracks did not extend far from the sample edges. Basic composite properties ? transverse strength and mode I toughness of unidirectional laminates ? were also measured at room temperature and -196-C to further determine the sources of the rise in damage accumulation.

DTIC

Carbon; Cryogenics; Exposure; High Temperature; Matrix Materials

20080002973 Ministry of Supply, London, UK

Cyanamide from Urea and Thionyl Chloride or Sulphuryl Chloride

Pryde, A W; Watkinson, W J; Jun 1949; 8 pp.; In English

Report No.(s): AD-A474003; ERDE-5/M/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474003>

It is stated that cyanamide is formed by the reaction of thionyl chloride and urea. There is no yield quoted and conditions are not specifically stated. As urea is readily manufactured and comparatively cheap this reaction seemed worthy of investigation.

DTIC

Chlorides; Cyanamides; Ureas

20080003012 Army Research Lab., Aberdeen Proving Ground, MD USA

Low-Cost Production of Photonic Bandgap Materials Through Bubbling

O'Brien, Daniel J; Wetzel, Eric D; Sep 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474079; ARL-TR-4277; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474079>

Photonic bandgap materials (PBGs) prevent the propagation of electromagnetic waves across certain wavelengths the so-called bandgap. This behavior is the result of periodic variations in the material's dielectric constant, with the location of the bandgap as a function of the spacing between dielectric features. PBGs show great promise in optoelectronics as waveguides and in sensors. Unfortunately, the large-scale production of PBGs is difficult. This report proposes a simple low-cost method for PBGM production. A device has been constructed that produces micrometer-sized, monodisperse bubbles that can be assembled into a crystal lattice by surface tension. The bubble crystals can be solidified and preserved using an aqueous acrylamide monomer solution as the medium for bubbling.

DTIC

Electromagnetic Wave Transmission; Energy Gaps (Solid State); Foams; Low Cost; Photonics

20080003089 Army Research Office, Research Triangle Park, NC USA
Army Research Office and Air Force Office of Scientific Research Contractors' Meeting in Chemical Propulsion Held in Arlington, Virginia on June 12-14, 2006

McNesby, Kevin; Tishkoff, Julian M; Jun 2006; 165 pp.; In English

Report No.(s): AD-A474195; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Abstracts are given for 6.1 basic research in chemical propulsion sponsored by the Army Research Office and the Air Force Office of Scientific Research.

DTIC

Chemical Propulsion; Contractors; Fuels; Propulsion; Thermochemistry

20080003099 Explosives Research and Development Establishment, Waltham Abbey, UK
The Nitration of Guanidine Nitrate Small Scale Pilot Plant

Pryde, A W; Martin, T; Nov 1950; 24 pp.; In English

Report No.(s): AD-A474233; ERDE-16/R-50; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Guanidines; Nitrates; Nitration; Pilot Plants

20080003108 Explosives Research and Development Establishment, Waltham Abbey, UK
The Preparation and Properties of Diethylene Glycol Dinitrate. Part 6: Conclusions and Recommendation

Smith, S E; Nov 1949; 12 pp.; In English

Report No.(s): AD-A474243; ERDE-21/R/49-PT-6; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Chemical Properties; Dinitrates; Ethers; Glycols

20080003111 Explosives Research and Development Establishment, Waltham Abbey, UK
The Preparation and Properties of Diethylene Glycol Dinitrate. Part 3: Batch Plant Manufacture

Smith, S E; Nov 1949; 52 pp.; In English

Report No.(s): AD-A474254; ERDE-2/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of the investigation was to examine the properties of diethylene glycol dinitrate, and to develop a method for its manufacture from diethylene glycol. The scope of the investigation: the requirements of commercial diethylene glycol for nitration to the dinitrate for Service use have been investigated. The optimum conditions for the nitration, and for the stabilization of diethylene glycol dinitrate have been determined by laboratory and semi-technical scale investigations, and batch and continuous pilot plants for these operations have been developed.

DTIC

Dinitrates; Ethers; Glycols; Nitrates

20080003116 Explosives Research and Development Establishment, Waltham Abbey, UK
The Synthesis of Guanidine from Urea. Part 3

Roberts, E; Griffiths, J V; Nov 1949; 74 pp.; In English

Report No.(s): AD-A474274; ERDE-41/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To develop a process for the production of nitroguanidine (piorite) based on urea

DTIC

Guanidines; Ureas

20080003304 Army Research Lab., Aberdeen Proving Ground, MD USA
Shot-Peening Sensitivity of Aluminum With Corrosion-Preventive Coatings

Grendahl, Scott; Snoha, Daniel; Nov 2007; 60 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-7DDAT00199

Report No.(s): AD-A474461; ARL-TR-4304; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Aviation and Missile Research, Development, and Engineering Center Aviation Engineering Division (Huntsville, AL) requested that the U.S. Army Research Laboratory Weapons and Materials Research Directorate (Aberdeen Proving Ground, MD) execute a program aimed at evaluating the shot-peening sensitivity of 7075-T73 aluminum with U.S. Army corrosion-preventive coatings for aluminum. The coatings represent the two most common coatings for aviation

aluminum alloys. The study was a follow-up to previous work that investigated shot-peening sensitivity on the base material. During that study, it was discovered that the aluminum alloy showed decreased fatigue strength when shot-peened at high Almen intensities. The present study focuses on the shot-peening interaction with the coatings. Both studies develop data to correlate surface roughness, x-ray diffraction residual stress analysis, and fatigue strength at a prescribed stress intensity, $K_t = 1.75$.

DTIC

Aluminum; Anodizing; Coatings; Corrosion Prevention; Peening; Sensitivity; Shoes; Shot Peening; Surface Finishing

20080003362 Explosives Research and Development Establishment, Waltham Abbey, UK

Interim Report on the Determination of the Crystal Structure of Oxamide

Duke, J R; Jun 1949; 15 pp.; In English

Report No.(s): AD-A474292; ERDE-12/M/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The crystal structure of oxamide has been examined by X-ray methods employing 2-dimensional Patterson & Pourier projections. An interim report is presented, covering the results so far obtained, and giving details of atomic coordinates, bond lengths and angles, and intermolecular separations; the estimated error of bond lengths is less than plus or minus 0.05A.

DTIC

Crystal Structure; Molecular Interactions

20080005231 Army Research Lab., Aberdeen Proving Ground, MD USA

Thermal Coating for Insensitive-Munitions Technologies

Smith, Pauline; Nov 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474504; ARL-TR-4317; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army is evaluating coatings for ammunition containers. An intumescent coating system for fire and heat protection is required for packaged 60-mm mortar cartridges to pass fast cookoff requirements. An intumescent coating has all the properties of ordinary paint; furthermore, this coating will not sustain combustion. Consequently, it will not burn and will provide a high degree of protection to the subsurface. Upon exposure to flame or heat, it immediately foams and swells, contributing an effective insulation and heat shield for the subsurface. In the event of fire, rather than contributing to the obstruction, it activates, prevents any flame spread, and eliminates flashover between walls and ceilings. For this project, the coatings primarily function as a defense in case of fire and prevent detonation on ammunition containers.

DTIC

Coating; Explosives; Fires

20080005379 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Viscoelastic Characterization of Aliphatic Polyurethane Interlayers

MacAloney, Neil; Bujanda, Andres; Jensen, Robert; Goulbourne, Nakhiah; Oct 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-2-0014; Proj-AH42

Report No.(s): AD-A474714; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The viscoelastic properties of several commercially available aliphatic thermoplastic polyurethanes were characterized. Differential scanning calorimetry showed that for Deerfield 4700, Inter Materials IM 800, IM 800A, IM 1600, and IM 2500, there is a permanent physical change that occurs during heating. Dynamic mechanical analysis and shear rheometry were used to generate elastic and shear modulus master curves in the frequency domain for Inter Materials IM 800 A. The Williams-Landel-Ferry constants and Prony coefficients were extracted from these master curves. Quasi-static mechanical properties were determined from tensile tests on dog bone samples and compression tests on cylindrical samples. Visual image correlation was used to determine the Poisson's ratio from the mechanical tests by simultaneously capturing longitudinal and lateral strain.

DTIC

Aliphatic Compounds; Heat Measurement; Interlayers; Polyurethane Resins; Viscoelasticity

20080005638 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

NMR Identification and MS Conformation of the Scopolamine Neurotoxin

Henderson, Terry J; Cullinan, David B; Oyler, Jonathan M; Nov 2007; 33 pp.; In English

Report No.(s): AD-A474812; ECBC-TR-592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474812>

An unidentified white powder collected as evidence in an intelligence investigation was characterized exclusively by

NMR analysis. A small fraction of the powder dissolved in D₂O was subjected to quantitative ¹H and ¹³C{¹H} experiments and a series of two-dimensional correlation techniques, including ¹H-¹H COSY and NOESY as well as ¹H-(exp ¹³C) HSQC and HMBC spectroscopy. These were used to elucidate the molecular structure of the powder's major component and positively identify it as the scopolamine biotoxin. To confirm the NMR results, an ethanol/H₂O solution of the powder was analyzed by direct infusion into an ion trap mass spectrometer. A prominent base signal at m/z 304.1 was observed, consistent with the protonated molecular ion of scopolamine. Comparisons of ¹H and ¹³C chemical shift values and JHH values measured from the NMR data were found to agree very favorably with previously reported values for scopolamine in D₂O.

DTIC

Hyoscine; Mass Spectrometers; Nuclear Magnetic Resonance; Toxins and Antitoxins

20080005675 Air Force Research Lab., Wright-Patterson AFB, OH USA

Development of Novel Two-Photon Absorbing Chromophores

Cooper, Thomas M; Heinrichs, James; Tan, Loon-Seng; Urbas, Augustine M; Fleitz, Paul A; Rogers, Joy E; Slagle, Jonathan E; McLean, Daniel G; Sutherland, Richard L; Brant, Mark; Aug 2006; 15 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A474846; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There has been much interest in the development of two-photon absorbing materials and many efforts to understand the nonlinear absorption properties of these dyes, but this area is still not well understood. A computational model has been developed in our lab to understand the nanosecond nonlinear absorption properties that incorporate all of the measured one-photon photophysical parameters of a class of materials called AFX. We have investigated the nonlinear and the photophysical properties of the AFX chromophores including the two-photon absorption cross-section, the excited state cross-section, the intersystem crossing quantum yield, and the singlet and triplet excited state lifetimes using a variety of experimental techniques that include UV-visible, fluorescence and phosphorescence spectroscopy, time correlated single photon counting, ultrafast transient absorption, and nanosecond laser flash photolysis. The model accurately predicts the nanosecond nonlinear transmittance data using experimentally measured parameters.

DTIC

Chromophores; Photons

20080005677 Yonsei Univ., Seoul, Korea, Republic of

Characterization of Hybrid Devices Based on Molecular Solid/Oxide Semiconductor Hetero-Structures

Kim, Changyoung; Sep 19, 2007; 3 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0052

Report No.(s): AD-A474848; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The work covered development of a semiconductor hetero-structures growth chamber to the existing photoemission chamber to characterize hybrid devices based on molecular solid/oxide structures. The work also investigated on developing optimum growth conditions for the desired Fermi level and work functions for different heterostructures.

DTIC

Laboratory Equipment; Oxides; Photoelectric Emission; Semiconductor Devices

20080006072 NASA Glenn Research Center, Cleveland, OH, USA

High-Heat-Flux Cyclic Durability of Thermal and Environmental Barrier Coatings

Zhu, Dongming; Ghosn, Louis L.; Miller, Robert A.; September 18, 2007; 21 pp.; In English; Materials Science and Technology 2007 Conference and Exhibition, 16-20 Sep. 2007, Detroit, MI, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; Copyright; Avail.: CASI: A03, Hardcopy

Advanced ceramic thermal and environmental barrier coatings will play an increasingly important role in future gas turbine engines because of their ability to protect the engine components and further raise engine temperatures. For the supersonic vehicles currently envisioned in the NASA fundamental aeronautics program, advanced gas turbine engines will be used to provide high power density thrust during the extended supersonic flight of the aircraft, while meeting stringent low emission requirements. Advanced ceramic coating systems are critical to the performance, life and durability of the hot-section components of the engine systems. In this work, the laser and burner rig based high-heat-flux testing approaches were developed to investigate the coating cyclic response and failure mechanisms under simulated supersonic long-duration cruise mission. The accelerated coating cracking and delamination mechanism under the engine high-heat-flux, and extended

supersonic cruise time conditions will be addressed. A coating life prediction framework may be realized by examining the crack initiation and propagation in conjunction with environmental degradation under high-heat-flux test conditions.

Author

Thermal Control Coatings; Life (Durability); Ceramic Coatings; Heat Flux; High Thrust

20080006105 Air Force Research Lab., Wright-Patterson AFB, OH USA

Effects of Solvation On One- and Two-Photon Spectra of Coumarin Derivatives: A TDDFT Study (Preprint)

Nguyen, Kiet A; Day, Paul N; Pachter, Ruth; Oct 2006; 36 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475003; AFRL-ML-WP-TP-2007-527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475003>

We report one- (OPA) and two-photon absorption (TPA) excitation energies and cross sections for a series of 7-aminocoumarins using time-dependent density functional theory with various basis sets and functionals, including exchange-correlation functionals using the Coulomb-attenuating method (CAMB3LYP and mCAMB3LYP), to evaluate their performance in gas-phase and in solvents. Except for the CAMB3LYP results, the computed OPA excitation energies and transition dipole moments are in good agreement with experiment. The range of errors obtained from various functionals is discussed in detail. The relationship of donor and acceptor groups with OPA and TPA resonances and intensities is also discussed.

DTIC

Anhydrides; Esters; Photons; Solvation

20080006135 Air Force Research Lab., Wright-Patterson AFB, OH USA

Polymer Film with Optically Controlled Form and Actuation (Postprint)

Bunning, Timothy; Tabiryman, Nelson; Serak, Svetlana; Dai, Xiao-Man; Sep 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475056; AFRL-ML-WP-TP-2007-546; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475056>

A low power laser beam is used to induce large and fast variations in the shape of a polymer film due to photoinduced contraction and expansion of the polymer film surface subject to the beam. The direction of the photoinduced bend or twist of the polymer can be reversed by changing the polarization of the beam. Thus the film orientation could be varied within + or - 70 deg. The phenomenon is a result of optically induced reorientation of azobenzene moieties in the polymer network.

DTIC

Laser Beams; Liquid Crystals; Photochemical Reactions; Polymeric Films

20080006143 Air Force Research Lab., Wright-Patterson AFB, OH USA

Asymmetry in Platinum Acetylide Complexes: Confinement of the Triplet Exciton to the Lowest Energy Ligand (Postprint)

Cooper, Thomas M; Krein, Douglas M; Burke, Aaron R; McLean, Daniel G; Rogers, Joy E; Slagle, Jonathan E; Oct 11, 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475099; AFRL-ML-WP-TP-2007-540; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475099>

As part of an ongoing investigation of structure-optical property relationships in asymmetric platinum acetylide complexes, we synthesized the compounds trans-Pt(PBu₃)₂(C equivalent CC₆H₅)(C equivalent C-C₆H₄-C equivalent CC₆H₅) (PE1-2), trans-Pt(PBu₃)₂-(C equivalent CC₆H₅)(C equivalent C-C₆H₄-C equivalent C-C₆H₄-C equivalent CC₆H₅) (PE1-3), and trans-Pt(PBu₃)₂(C equivalent C-C₆H₄-C equivalent CC₆H₅)-(C equivalent C-C₆H₄-C equivalent C-C₆H₄-C equivalent CC₆H₅) (PE2-3) that have different ligands on either side of the central platinum and compared their spectroscopic properties to the symmetrical compounds PE1, PE2, and PE3. We measured trends in ground state absorption, fluorescence, phosphorescence, and triplet state absorption spectra. We also performed density functional theory calculations of the triplet state geometries and energies. The ground state absorption and fluorescence spectra give evidence the singlet exciton is

delocalized across the central platinum atom. In contrast, the behavior of the phosphorescence spectra suggests the triplet exciton is confined to one ligand. The phosphorescence from the asymmetric complexes comes from the lowest energy, most delocalized ligand. The triplet state geometries obtained from the density functional theory calculations show distortion on the lowest energy ligand, while the other ligand has the ground state geometry. The calculated trend in the triplet state energies agrees very well with the experimental trend. Calculations of triplet state spin density also show the triplet exciton is confined to one ligand. In the asymmetric complexes the spin density is confined to the more conjugated, lower energy ligand. The results show Kasha's rule applies to these complexes, where following excitation and intersystem crossing, the triplet exciton moves to the lowest energy ligand.

DTIC

Asymmetry; Atomic Energy Levels; Confinement; Excitons; Ligands; Platinum; Platinum Compounds

20080006146 Air Force Research Lab., Wright-Patterson AFB, OH USA

Effects of Conjugation in Length and Dimension on Spectroscopic Properties of Fluorene-Based Chromophores from Experiment and Theory (Preprint)

Tao, Loon-Seng; Fleitz, Paul A; Pachter, Ruth; Nguyen, Kiet A; Rogers, Joy E; Slagle, Jonathan E; Day, Paul N; Kannan, Ramamurthi; Jul 2006; 38 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475103; AFRL-ML-WP-TP-2007-539; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475103>

A series of one-photon (OPA) absorption spectra for fluorine-based donor pi acceptor molecules is presented and spectroscopically assigned, based upon the results obtained from time-dependent density functional theory (TDDFT). The computed excitation energies were generally shown to be in good agreement with experiment, particularly when compared to results from measurements carried out in a nonpolar solvent, which were available for some molecules. The computed oscillator strengths may resolve discordant experimental values in some cases, for example, for AF-380, AF-270, and AF-295. However, a quantitative comparison between computed and observed oscillator strengths is complicated by band overlapping. Thus, the computed extinction coefficients obtained by summing over the Gaussian bands are useful in such cases.

DTIC

Chromophores; Conjugation; Length; Spectroscopy

20080006457 NASA Glenn Research Center, Cleveland, OH, USA

Carbon Dioxide Reduction on Gadolinia-Doped Ceria Cathodes

Green, Robert D.; Liu, Chung-Chiun; Adler, Stuart B.; [2008]; 58 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 825080.04.02.20.08; Copyright; Avail.: Other Sources

AC impedance spectroscopy has been performed on 40 mol% gadolinia-doped ceria electrodes on yttria stabilized zirconia (YSZ) at 700-950C in reducing CO/CO₂ atmospheres. Area-specific-resistance (ASR) values for this electrode were in the range of 0.8-37 ohm-cm², about two orders of magnitude lower than measurements on Pt electrodes and slightly lower than data on Ni-YSZ electrodes in the literature under similar temperature and partial pressure of oxygen (P_{O₂}) conditions. A continuum-based model of this porous electrode is described and an analysis performed to extract the vacancy diffusion coefficient (D_v) and surface exchange rate coefficient (R₀) as a function of temperature and P_{O₂}, from the impedance results. The D_v data agree reasonably well with published measurements of the tracer diffusion coefficient (D*) based on isotope profiling by secondary ion mass spectroscopy (SIMS) and conductivity measurements on 40 mol% GDC. The R₀ values are a factor of 3 lower than published measurements of the surface reaction rate (k) obtained from isothermal thermogravimetric relaxation and decreases with increasing P_{O₂}. Values of the thermodynamic factor (ΔG) calculated from the fitted model parameters also matched well with those calculated from oxygen non-stoichiometry data in the literature.

Author

Carbon Dioxide; Cathodes; Cerium Compounds; Yttria-Stabilized Zirconia; Reduction (Chemistry)

20080006462 NASA Glenn Research Center, Cleveland, OH, USA

Surface Analysis of 4-Aminothiophenol Adsorption at Polycrystalline Platinum Electrodes

Rosario-Castro, Belinda I.; Fachini, Estevo R.; Contes, Enid J.; Perez-Davis, Marla E.; Cabrera, Carlos R.; [2006]; 22 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NGT3-52381; WBS 620855.04.01.03.01; Copyright; Avail.: CASI: A03, Hardcopy

Formation of self-assembled monolayer (SAM) of 4-aminothiophenol (4-ATP) on polycrystalline platinum electrodes has been studied by surface analysis and electrochemistry techniques. The 4-ATP monolayer was characterized by cyclic voltammetry (CV), Raman spectroscopy, reflection absorption infrared (RAIR) spectroscopy, and X-ray photoelectron spectroscopy (XPS). Cyclic voltammetry (CV) experiments give an idea about the packing quality of the monolayer. RAIR and Raman spectra for 4-ATP modified platinum electrodes showed the characteristic adsorption bands for neat 4-ATP indicating the adsorption of 4-ATP molecules on platinum surface. The adsorption on platinum was also evidenced by the presence of sulfur and nitrogen peaks by XPS survey spectra of the modified platinum electrodes. High resolution XPS studies and RAIR spectrum for platinum electrodes modified with 4-ATP indicate that molecules are sulfur-bonded to the platinum surface. The formation of S-Pt bond suggests that ATP adsorption gives up an amino terminated SAM. Thickness of the monolayer was evaluated via angle-resolved XPS (AR-XPS) analyses. Derivatization of 4-ATP SAM was performed using 16-Br hexadecanoic acid.

Author

Absorption Spectroscopy; Adenosine Triphosphate; Infrared Spectroscopy; Raman Spectroscopy; Photoelectron Spectroscopy; High Resolution; Electrodes; Electrochemistry; Polycrystals

24

COMPOSITE MATERIALS

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

20080003031 Royal Aircraft Establishment, Farnborough, UK

Report on Visits with Mr. A.G.P. Vaughan and Mr. J. Hardwick of I.C.I. Ltd. to U.S. Firms Engaged in the Development of Reinforced Plastic Rocket Motor Bodies, 23rd November to 8th December, 1953

Lloyd, T.; Feb 1954; 35 pp.; In English

Report No.(s): AD-A474134; RAE-CHEM-1218; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474134>

No abstract available

Plastic Bodies; Reinforced Plastics; Rocket Engines

20080005351 National Univ. of Singapore, Singapore

Design and Development of a Super Permeability Nanostructured Permalloy Composite

Li, Xiaoping; Nov 20, 2007; 47 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0035

Report No.(s): AD-A474664; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Theoretical analysis and modeling have been made on the magnetic behavior of ferromagnetic nanowire arrays. The design guidelines for composite ferromagnetic functional materials have been developed. The ferromagnetic functional materials should be insulated to increase sensitivity. In addition, its effective volume was studied to maximize ferromagnetism sensitivity based on the number of nanowire arrays. The dynamic domain unification principle dictated the ferromagnetic wires need to be in the array format and need to be as closely as possible each other to maximize the sensitivity.

DTIC

Composite Materials; Ferromagnetic Materials; Ferromagnetism; Nanowires; Permalloys (Trademark); Permeability; Wire

20080005388 Naval Postgraduate School, Monterey, CA USA

Identification of Stiffness Properties of Orthotropic Lamina using the Experimental Natural Frequencies and Mode Shapes

Ryou, Jung-Kyu; Gordis, Joshua H; Nov 1, 2007; 93 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474732; NPS-MAE-07-003; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Mechanical properties of advanced composite lamina are identified for better mathematical modeling of composite laminate for structural analysis. Each lamina is treated as an orthotropic material under plane stress state and are assumed to

be transversely isotropic. Four stiffness properties, (E_1 , E_2 , ν_{12} , G_{12}), are treated as design variables for minimization of a performance index. The differences between analytically obtained and experimental natural frequencies for the specimen, along with a proper weighting scheme for each mode, are minimized using the optimization routine, `fmincon` in the MATLAB optimization toolbox. The modal assurance criterion is utilized to construct the weighting to express the degree of correlation between mode shape vectors obtained experimentally and derived analytically. This study requires a series of experimental results; natural frequencies and corresponding mode shapes of the specimen. A computational tool has been developed as a result of this study. Numerical examples are investigated to demonstrate the performance of this approach. Further study with experiments may show practical benefit of current method for characterization of mechanical properties of advanced composite materials.

DTIC

Composite Materials; Laminates; Resonant Frequencies; Stiffness; Vibration Mode

20080005534 NASA Glenn Research Center, Cleveland, OH, USA

Improving Turbine Performance with Ceramic Matrix Composites

DiCarlo, James A.; October 31, 2007; 25 pp.; In English; NASA Fundamental Aeronautics Annual Meeting, 31 Oct. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005534>

Under the new NASA Fundamental Aeronautics Program, efforts are on-going within the Supersonics Project aimed at the implementation of advanced SiC/SiC ceramic composites into hot section components of future gas turbine engines. Due to recent NASA advancements in SiC-based fibers and matrices, these composites are lighter and capable of much higher service temperatures than current metallic superalloys, which in turn will allow the engines to operate at higher efficiencies and reduced emissions. This presentation briefly reviews studies within Task 6.3.3 that are primarily aimed at developing physics-based concepts, tools, and process/property models for micro- and macro-structural design, fabrication, and lifing of SiC/SiC turbine components in general and airfoils in particular. Particular emphasis is currently being placed on understanding and modeling (1) creep effects on residual stress development within the component, (2) fiber architecture effects on key composite properties such as design strength, and (3) preform formation processes so that the optimum architectures can be implemented into complex-shaped components, such as turbine vanes and blades.

Author

Ceramic Matrix Composites; Gas Turbine Engines; Heat Resistant Alloys; Turbine Blades; Structural Design; Composite Materials; Engine Parts; Airfoils

20080005606 Institute of Medical Science, Tokyo, Japan

Wireless Damage Monitoring of Laminated CFRP Composites using Electrical Resistance Change

Todoroki, Akira; Feb 25, 2007; 16 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0720; Proj-AOARD-05-4096

Report No.(s): AD-A474739; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474739>

It is difficult to detect delamination of rotating composite components like helicopter and wind turbine blades while in-service with a wired system. In the present study, a wireless system using a tiny oscillation circuit for detecting delamination of carbon/epoxy composites is proposed. In this system, a tiny oscillation circuit is attached to the composite component. When delimitation of the component occurs, electrical resistance changes, which causes a change in the oscillating frequency of the circuit. Since this system uses the composite structure itself as a sensor and the oscillating circuit is very small, it is applicable to rotating components. The electrical resistance change and oscillating frequency change due to delamination is experimentally measured using carbon/epoxy specimens. The effects of temperature changes are also measured. The wireless method is found to successfully detect embedded delamination, and to estimate the size of the delamination. The effect of temperature change is minimized by means of a temperature compensation circuit

DTIC

Carbon Fiber Reinforced Plastics; Circuits; Composite Materials; Damage; Delaminating; Electrical Properties; Electrical Resistance; Laminates; Oscillations

20080006057 Ohio Aerospace Inst., Cleveland, OH, USA; NASA Glenn Research Center, Cleveland, OH, USA

Advanced Woven SiC/SiC Composites for High Temperature Applications

Morscher, Gregory N.; October 28, 2007; 33 pp.; In English; Composites at Lake Louise Canada, 28 Oct. - 2 Nov. 2007, Lake Louise, Canada; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06ZA03A; WBS 599489.02.07.03.02.02.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006057>

The temperature, stress, and environmental conditions of many gas turbine, hypersonic, and even nuclear applications make the use of woven SiC/SiC composites an attractive enabling material system. The development in SiC/SiC composites over the past few years has resulted in significant advances in high temperature performance so that now these materials are being pursued for several turbine airfoil and reusable hypersonic applications. The keys to maximizing stress capability and maximizing temperature capability will be outlined for SiC/SiC. These include the type of SiC fiber, the fiber-architecture, and the matrix processing approach which leads to a variety of matrix compositions and structure. It will also be shown that a range of mechanical, thermal, and permeability properties can be attained and tailored depending on the needs of an application. Finally, some of the remaining challenges will be discussed in order for the use of these composite systems to be fully realized.

Author

Silicon Carbides; Composite Materials; Woven Composites; High Temperature; Thermodynamic Properties; Gas Turbines

20080006062 Ohio Aerospace Inst., Cleveland, OH, USA

Advanced Joining and Integration Technologies for Ceramic Matrix Composite Systems

Singh, Mrityunjay; Asthana, Rajiv N.; [2008]; 22 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07ZA02A; WBS 561581.02.08.03.16.02; Copyright; Avail.: Other Sources

Joining and integration of ceramic-matrix composites (CMCs) has been recognized as an enabling technology for a number of high-temperature applications in aerospace, power generation, nuclear, and transportation industries. Fundamental considerations and techniques for joining CMCs to metals and CMC to CMC are reviewed. The relationship of joining techniques to CMC manufacturing and joint integrity is highlighted. Joint design philosophies and design issues have been discussed along with some bonding and integration technologies. The mechanical properties and fractography of CMC joints are presented together with examples of joined CMC prototype subcomponents. Robust joining technologies are needed to manufacture large and complex shape components and with certain modifications, can be applied to repair of ceramic components damaged in service.

Author

Ceramic Matrix Composites; Fractography; Mechanical Properties; Technology Utilization; Ceramic Bonding; Metal Bonding

20080006149 Industrial Coll. of the Armed Forces, Washington, DC USA

Strategic Materials

Adelman, Eddie; Barlow, Cassie; Chamberlin, Eric; Fulton, James; Galvin, Jim; Good, Chuck; Goodyear, Sue; Kosiak, Igor; Moran, Mike; Ockenfels, Tom; Jan 2007; 27 pp.; In English

Report No.(s): AD-A475111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475111>

The ability of U.S. defense firms to gain reliable, timely, and affordable access to the materials needed to produce defense products is critical to U.S. national security. When the supply of materials required by these firms becomes vulnerable and no material substitutions are available, the material can be classified as 'strategic.' These strategic materials warrant scrutiny to ensure associated risks are mitigated. A close examination of the 'light armor' industry serves to demonstrate the importance of strategic materials, describe the dynamics of this industry, and reveal needed adjustments to government policy that can reduce strategic risk and enhance U.S. national security.

DTIC

Armor; Defense Industry; Military Technology; Strategic Materials; Technology Assessment

20080006326 Princeton Univ., NJ USA

Optimally Designed Multifunctional Composites

Torquato, Salvatore; Mar 11, 2007; 8 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0406

Report No.(s): AD-A475234; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Optimally designed composite materials offer the best material systems to achieve the many demands that are being

placed on structures and components in Air Force applications. We have adapted the topology optimization method to design three-dimensional composite microstructures with multi functional characteristics. These include optimal multifunctional materials with optimal electrical conductivity, thermal conductivity, elastic moduli, dielectric constant, and fluid permeability. In many instances, the optimal microstructures were entirely new, and in all instances the designed materials are manufacturable.

DTIC

Composite Materials; Electrical Resistivity; Microstructure; Thermal Conductivity

20080006464 NASA Glenn Research Center, Cleveland, OH, USA

Tensile Creep and Fatigue of Sylramic-iBN Melt-Infiltrated SiC Matrix Composites: Retained Properties, Damage Development, and Failure Mechanisms

Morscher, Greg; Gowayed, yasser; Miller, Robert; Ojard, Greg; Ahmad, Jalees; Santhosh, Unni; John, Reji; January 27, 2008; 19 pp.; In English; 32nd International Conference and Exposition on Advanced Ceramics and Composites, 27 Jan. 1 Feb. 2008, Daytona Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): F33615-01-C-5234; F33615-03-D-2354-D004; NNC06ZA03A; WBS 599489.02.07.03.02.02.02; Copyright; Avail.: CASI: A03, Hardcopy

An understanding of the elevated temperature tensile creep, fatigue, rupture, and retained properties of ceramic matrix composites (CMC) envisioned for use in gas turbine engine applications are essential for component design and life-prediction. In order to quantify the effect of stress, time, temperature, and oxidation for a state-of-the-art composite system, a wide variety of tensile creep, dwell fatigue, and cyclic fatigue experiments were performed in air at 1204 C for the SiC/SiC CMC system consisting of Sylramic-iBN SiC fibers, BN fiber interphase coating, and slurry-cast melt-infiltrated (MI) SiC-based matrix. Tests were either taken to failure or interrupted. Interrupted tests were then mechanically tested at room temperature to determine the residual properties. The retained properties of most of the composites subjected to tensile creep or fatigue were usually within 20% of the as-produced strength and 10% of the as-produced elastic modulus. It was observed that during creep, residual stresses in the composite are altered to some extent which results in an increased compressive stress in the matrix upon cooling and a subsequent increased stress required to form matrix cracks. Microscopy of polished sections and the fracture surfaces of specimens which failed during stressed-oxidation or after the room-temperature retained property test was performed on some of the specimens in order to quantify the nature and extent of damage accumulation that occurred during the test. It was discovered that the distribution of stress-dependent matrix cracking at 1204 C was similar to the as-produced composites at room temperature; however, matrix crack growth occurred over time and typically did not appear to propagate through thickness except at final failure crack. Failure of the composites was due to either oxidation-induced unbridged crack growth, which dominated the higher stress regime (> 179 MPa) or controlled by degradation of the fibers, probably caused by intrinsic creep-induced flaw growth of the fibers or internal attack of the fibers via Si diffusion through the CVI SiC and/or microcracks at the lower stress regime (< 165 MPa).

Author

Tensile Creep; Thermal Fatigue; Creep Properties; Gas Turbine Engines; Life (Durability); Time Temperature Parameter; Stresses; Oxidation; Crack Propagation

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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*.

20080002922 Molecular Research Inst., Mountain View, CA, USA

Modeling Chemical Growth Processes in Titan's Atmosphere: 1. Theoretical Rates for Reactions between Benzene and the Ethynyl (C₂H) and Cyano (CN) Radicals at Low Temperature and Pressure

Woon, David E.; Chemical Physics; September 27, 2006; Volume 331, Issue 1, pp. 67-76; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG05GO75G; NAG5-12305; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1016/j.chemphys.2006.09.028>

Density functional theory calculations at the B3LYP/6-31+G** level were employed to characterize the critical points for adducts, isomers, products, and intervening transition states for the reactions between benzene and the ethynyl (C₂H) or cyano

(CN) radicals. Both addition reactions were found to have no barriers in their entrance channels, making them efficient at the low temperature and pressure conditions that prevail in the haze-forming region of Titan's atmosphere as well as in the dense interstellar medium (ISM). The dominant products are ethynylbenzene (C₆H₅C₂H) and cyanobenzene (C₆H₅CN). Hydrogen abstraction reactions were also characterized but found to be non-competitive. Trajectory calculations based on potentials fit to about 600 points calculated at the ROMP2/6-31+G** level for each interaction surface were used to determine reaction rates. The rates incorporated any necessary corrections for back reactions as ascertained from a multiwell treatment used to determine outcome distributions over the range of temperatures and pressures pertinent to Titan and the ISM and are in good agreement with the limited available experimental data.

Author

Titan; Satellite Atmospheres; Chemical Reactions; Benzene; Cyano Compounds; Reaction Kinetics

20080002930 Rice Univ., Houston, TX USA

Logic Nanocells Within 3-Terminal Ordered Arrays

Tour, James M; Feb 28, 2007; 58 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0476; Proj-U029

Report No.(s): AD-A473904; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473904>

Our overall technical approach to this project consisted of the following elements: (1) A rich set of chemistries available to form the channel of a moleware device, and considerable insight and experience into the functionality of the device and these chemistries. We have in-depth experience in attachment chemistries to both metals and semiconductors. Note that worldwide, more groups are experimenting with the chemical basis set developed in our program, than any other chemical basis set; (2) A complete numerical tool-kit for modeling of large molecular-organic systems from first-principles. Numerical simulation is essential for device fine-tuning due to the complexity of the overall structure. The same situation is true in the MOSFET world; physics-based models permit high-level understanding and are useful in device simulation, while numerical models are used for detailed devices; (3) a simple concept for building 3-terminal devices. Note this is a Field Effect device (like a MOSFET); (4) approaches to further define molecular signatures on molecules bound to metals and to semiconductors; (5) interface of molecules to MOSFETs via a diverse set of chemistries in an effort to exploit the best of both architectures and thereby be poised for the nanoscale solid state revolution wherein the devices have a high surface area; molecules doping the surface for controlling the transconductance.

DTIC

Field Effect Transistors; Semiconductors (Materials)

20080002934 Tufts Univ., Medford, MA USA

Silk Polymer Designs for Improved Expression and Processing

Kaplan, David L; Oct 28, 2007; 5 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0363

Report No.(s): AD-A473922; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473922>

Silk fibers formed by insects and spiders are noted for their remarkable mechanical properties as well as their durability and biocompatibility. The exceptional solubility in vivo (20-30% w/v) of these proteins is dictated by both the need to produce solid fibers with a high packing fraction and the high mesogen concentration required for lyotropic liquid crystalline spinning, while also achieving high end mechanical properties for survival (orb webs, cocoons). Combining knowledge of the solution state behavior, protein folding requirements and silk genetic/protein designs employing complex block- copolymer attributes, offers new experimental directions. Our objective was to determine the relationships between genetic/protein block designs coupled with the limitations imposed by an all aqueous processing environment. The significance of the studies was that by employing these design rules there should be improved expression, recovery of soluble protein and control of processing into high solids solutions and gels leading to spinnable dopes for fibers, films or other material outcomes. The insights from the studies have implications in fundamental structural biology as well as direct utility toward improved options in silk-based polymer synthesis, processing and materials fabrication.

DTIC

Copolymers; Mechanical Properties; Nanocomposites; Silk

20080002939 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Evaluation of the Steris Sensitive Equipment Decontamination (SED) Apparatus on a 463L Pallet

Lalain, Teri; Brickhouse, Mark D; Pfarr, Jerry; Lloyd, John; Flowers, James; Mantooth, Brent; Stark, David; Zander, Zach; Sep 2007; 152 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W9115R-04-C-0024

Report No.(s): AD-A473929; ECBC-TR-526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473929>

The STERIS Vaporous Hydrogen Peroxide (VHP(Registered)) technology has been used for more than a decade to sterilize pharmaceutical processing equipment and clean rooms. Through a joint partnership, the U.S. Army Edgewood Chemical and Biological Center (ECBC) and STERIS Corporation, Inc., subsidiary of Strategic Technology Enterprises (STE), began the process to co-develop a modified VHP (mVHP) capable of biological and chemical decontamination. Significant improvements have been made through a series of laboratory, chamber-scale, and large-scale efforts. The primary objective of this test was to determine the mVHP system ability to decontaminate representative articles of sensitive equipment and operationally relevant materials for biological-warfare agent surrogate contamination. A replica of the SED prototype decontamination chamber was constructed for use under engineering controls for live chemical agent evaluation. The biological-efficacy coupon and equipment tests were to determine the decontamination efficacy. The decontamination efficacy was compared to the KPPs stated in the ORD for JSSED. The secondary objective of this testing was to evaluate the impact of fumigant on the operability of the representative sensitive equipment. The tests were performed between October 2005 and March 2006 in a space provided by the 20th Support Command at ECBC.

DTIC

Biological Weapons; Chemical Warfare; Decontamination; Hydrogen Peroxide; Sensitivity

20080002955 Air Force Materiel Command, Wright-Patterson AFB, OH USA

Hybridized Photovoltaic Liquid Crystal Cells and Light Valves (Preprint)

Evans, D R; Cook, G; Carns, J L; Saleh, M A; Tabirian, N V; Jan 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473958; AFRL-ML-WP-TP-2007-499; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473958>

Can use PV field in LiNbO₃:Fe to activate a liquid crystal. This geometry utilizes the photorefractive effect in the substrates (two-beam coupling) and the scattering effect from the liquid crystal. A less ionic liquid crystal can be used to correct for effects of screening charges.

DTIC

Light Valves; Liquid Crystals; Lithium; Niobium; Photovoltaic Cells

20080002974 Ministry of Supply, London, UK

Ammonium Nitrate as an Oxidant for Composite Propellants. Part 1. Preliminary Considerations

Foreeman, P R; Sep 1954; 29 pp.; In English

Report No.(s): AD-A474004; ERDE-5/R/54; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474004>

The physical properties of ammonium nitrate are discussed from the point of view of its use as an oxidant in composite propellants. Some discrepancies in the literature are pointed out and an attempt is made to explain them. The maximum specific impulse obtainable with a simple ammonium nitrate/fuel mixture is about 223 sec. The advantage of using oxygenated fuels is calculated for cases where, because of rheological considerations, more than 5 or 6 per cent of fuel must be used. Slight caking of ammonium nitrate may occur at relative humidities less than the theoretical value for water absorption and it is suggested that this may be due either to occluded moisture or to welding between crystals in contact. Gross pick-up of moisture occurs at relative humidities above about 50 per cent, so that control of humidity during the manufacture and filling of composite propellants containing ammonium nitrate is essential.

DTIC

Ammonium Nitrates; Composite Propellants; Oxidizers

20080002975 Ministry of Supply, London, UK

An Assessment of Hydrazine, Hydrazine Hydrate and Liquid Ammonia as Fuels for Rocket Propulsion

Cooper, K A; Wiseman, L A; Aug 1949; 37 pp.; In English

Report No.(s): AD-A474005; ERDE-25/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474005>

The use of the fuels liquid ammonia, hydrazine hydrate and anhydrous hydrazine in the field of rocket propulsion has been assessed. It is concluded that liquid ammonia is not promising except possibly in small motors where its high vapor pressure may not be too severe a disadvantage. More data on the system Hydrazine/water, in which the concentration of water is less than in hydrazine hydrate, are desirable, and other methods of lowering the freezing point of anhydrous hydrazine should be investigated. If chlorine trifluoride is developed as an oxidant it will probably be essential to have hydrazine or hydrazine/water as the fuel.

DTIC

Fuels; Hydrates; Hydrazines; Liquid Ammonia; Propulsion

20080002976 Ministry of Supply, London, UK

The Assessment of Liquid Propellant Injectors. Part 1. Atomisation: Its Measurements and Influence on Combustion Efficiency of Rocket Motors

Adams, G K; Apr 1949; 48 pp.; In English

Report No.(s): AD-A474007; TR-28/R/48; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474007>

One of the advantages of the rocket motor over other propulsion units lies in its ability to achieve a high rate of conversion of chemical energy into kinetic energy in a relatively small volume. In order to maintain the high rate and density of combustion required, the propellant is injected into the combustion chamber in the form of a spray consisting of a large number of small droplets. This spray has a large surface area per unit volume, which facilitates the transfer of heat from the combustion gases to the liquid propellant. Thus the high rate of evaporation from the liquid to the gaseous phase, necessary to maintain combustion, is achieved.

DTIC

Combustion Efficiency; Combustion Products; Injectors; Liquid Rocket Propellants; Rocket Engines

20080002978 Ministry of Supply, London, UK

Calcium Cyanamide from Hydrogen Cyanide and Lime

Pryde, A W; Watkinson, W J; Jun 1949; 16 pp.; In English

Report No.(s): AD-A474009; ERDE-8/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474009>

A paper by Franck and Heiman in 'Zeitschrift für angewandte und Chemie, 1931' 372, claims high yield of Calcium Cyanamide from the reaction $\text{CaO} + 2\text{HCN} \rightarrow \text{CaCN}_2 + \text{CO} + \text{H}_2$. It was decided to repeat their work from the viewpoint of establishing a possible economical large scale process but omitting nitrogen as a carrier gas for the HCN.

DTIC

Calcium; Calcium Oxides; Cyanamides; Cyanides; Hydrogen

20080002979 Ministry of Supply, London, UK

A Note on the Thermochemistry of Fluorine and Its Compounds

Luft, N W; Wiseman, L A; Skinner, H A; Springall, H D; Jun 1949; 21 pp.; In English

Report No.(s): AD-A474010; ERDE-TM-6/M/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474010>

The recent direct determinations of the energy of dissociation of ClF into atoms necessitates a new value for the energy of dissociation of the Fluorine Molecule. It is shown that the new value of $D(\text{F}_2) = 32.6 \text{ k.cals/mol.}$ is qualitatively supported by bond energies and bond distances in certain compounds and a possible reason for this very low energy is suggested. This new value leads to considerable changes in the value of $D(\text{HF})$ and the strength of the carbon-fluorine bond in CF_4 . Suggestions for further work to confirm this new value are made.

DTIC

Fluorine; Thermochemistry

20080003017 Georgia Inst. of Tech., Atlanta, GA USA

Giant Enhancement in UV Response of ZnO Nanobelts by Polymer Surface-Functionalization

Lao, Chang Shi; Park, Myung-Chul; Kuang, Qin; Deng, Yulin; Sood, Ashok K; Polla, Dennis L; Wang, Zhong L; Jan 2007; 3 pp.; In English

Report No.(s): AD-A474086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474086>

Zinc oxide (ZnO) is one of the most important nanomaterials for nano-optoelectronics, sensors, transistors, and nanopiezotronics. Because of the unique piezoelectric and semiconducting dual properties, ZnO nanowires (NWs) and nanobelts (NBs) are the fundamental material for nanogenerators, which convert mechanical energy into electricity. With a band gap of ~3.4 eV and an exciton binding energy of 60 meV, ZnO has huge promise for optical applications, such as UV detection. However, because of the presence of point defects and confined dimensionality, the UV sensitivity of ZnO NWs and NBs is limited. In this paper, we demonstrate that the UV response of a ZnO NB based sensor has been enhanced by close to 5 orders of magnitude after functionalizing its surface with a polymer that has a high UV absorption ability. This giant enhancement in photoconductance is attributed to the energy levels introduced by the polymer lying in the corresponding band gap and in the conduction band of ZnO, which served as a 'hopping' state and increased the excitation probability of an electron to the conduction band. This exciting discovery will greatly impact the applications of ZnO NWs/NBs for UV detection.

DTIC

Augmentation; Nanostructures (Devices); Polymers; Surface Properties; Ultraviolet Detectors; Zinc Oxides

20080003018 Royal Aircraft Establishment, Farnborough, UK

Ignition Characteristics at Low Ambient Pressures of a Full-Scale Injector Using H.T.P. and C-Fuel

Humphries, J; Jun 1951; 25 pp.; In English

Report No.(s): AD-A474088; RAE-TN-RPD-49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474088>

No abstract available

Ignition; Injectors; Low Pressure

20080003019 Royal Aircraft Establishment, Farnborough, UK

Investigation of Rough Running of a Rocket Burner and Observations on 'Short Tube' Injection Orifices

Hagerty, R P; Jessen, F C; Jun 1951; 27 pp.; In English

Report No.(s): AD-A474090; RAE-TN-RPD-51; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474090>

No abstract available

Burners; Injection; Orifices; Rocket Engines

20080003020 Howard Univ., Washington, DC USA

Electronic Transport Control of Bi Nanowires

Huber, Tito E; Sep 7, 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0303

Report No.(s): AD-A474091; 43807-MS-H 10; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474091>

Theoretical models of the effect of quantum confinement in nanowire arrays show that thermoelectric cooler efficiency can be enhanced several-fold using this strategy. Previous experimental studies of well characterized samples failed to show an enhancement of the thermopower, but the reason for this failure was not identified. We show that bismuth nanowires have, in addition to bulk electrons and holes, a third type of charge carriers (surface charges). The effect of surface charges is to shift the range of diameters over which the relevant phenomena occurs. We investigated the range of diameters 20-200 nm and report thermopower enhancements in 35 nm Bi nanowire arrays. We also show that array's thermoelectric properties can be further optimized by applying a magnetic field.

DTIC

Bismuth; Electronic Control; Nanowires; Thermoelectric Cooling

20080003024 Explosives Research and Development Establishment, Waltham Abbey, UK
Technical Report for the Period 1 January 1963 to 30 June 1963

Aug 23, 1963; 69 pp.; In English

Report No.(s): AD-A474100; ERDE-TR-1/63; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474100>

The four hydrazine perchlorates, viz. hydrazine perchlorate and its hemihydrate, and hydrazine diperchlorate and its dihydrate have been made in quantities of a few hundred grams from hydrazine and 'Analar' grade sixty per cent perchloric acid. The monoperochlorate presents little difficulty; the extreme impact sensitiveness which has been reported (with F.I. worse than lead azide) has not been found even on material shown by the Karl Fischer test to be anhydrous. The dihydrate of hydrazine diperchlorate is also easy to obtain by mixing the cooled constituents. It is best dehydrated by low pressures (0.01 tor) at room temperature with a liquid nitrogen trap or phosphorus pentoxide to take up the water; it is not easy to avoid loss of some perchloric acid, and the analysis is often low in acid (the second perchloric acid titrates in aqueous solution as free acid). No solvent has been found for recrystallization of the anhydrous material; it hardly dissolves in liquid sulphur dioxide, and loses perchloric acid on washing with ether, tetrahydrofuran, and many others.

DTIC

Hydrazines; Perchlorates

20080003032 Royal Aircraft Establishment, Farnborough, UK
Some Considerations Relating to Combustion in Rocket Motors

Maxwell, W R; Mar 1950; 19 pp.; In English

Report No.(s): AD-A474135; RAE-TN-RPD-30; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474135>

An account is given of some of the problems associated with combustion in rocket motors and it is shown that the improvements in rocket motor performance which may result from a greater knowledge of the combustion process are considerable. Suggestions are made for tackling some of the problems involved.

DTIC

Combustion; Rocket Engines

20080003038 University of Southern California, Los Angeles, CA USA

A Divide-and-Conquer/Cellular-Decomposition Framework for Million-to-Billion Atom Simulations of Chemical Reactions

Nakano, Aiichiro; Kalia, Rajiv K; Nomura, Ken-ichi; Sharma, Ashish; Vashishta, Priya; van Duin, Fuyuki Shimojo; dri C; Goddard, William A; Biswas, Rupak; Srivastava, Deepak; Jan 2007; 12 pp.; In English

Report No.(s): AD-A474161; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474161>

To enable large-scale atomistic simulations of material processes involving chemical reactions, we have designed linear-scaling molecular dynamics (MD) algorithms based on an embedded divide-and-conquer (EDC) framework: first principles-based fast reactive force-field (F-ReaxFF) MD; and quantum-mechanical MD in the framework of the density functional theory (DFT) on adaptive multigrids. To map these O(N) algorithms onto parallel computers with deep memory hierarchies, we have developed a tunable hierarchical cellular-decomposition (THCD) framework, which achieves performance tunability through a hierarchy of parameterized cell data/computation structures and adaptive load balancing through wavelet-based computational-space decomposition.

DTIC

Atoms; Chemical Reactions; Decomposition; Simulation

20080003094 Explosives Research and Development Establishment, Waltham Abbey, UK
Calculation of the Explosive Power of Mixtures of Chlorine Trifluoride and Ammonia (Both Liquid)

Young, G H; Jul 1951; 10 pp.; In English

Report No.(s): AD-A474218; ERDE-TM-8/M/51; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Ammonia; Chlorine Fluorides; Explosives

20080003103 Explosives Research and Development Establishment, Waltham Abbey, UK
A Miniature Proofstand for Precise Physical Measurements on Rocket Motors
Wiseman, L A; Ziebland, H; Aug 1949; 41 pp.; In English
Report No.(s): AD-A474237; ERDE-30/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Dimensional Measurement; Flames; Miniaturization; Rocket Engines

20080003107 Explosives Research and Development Establishment, Waltham Abbey, UK
The Manufacture of Silver Azide R.D. 1336
Taylor, G W; Feb 1950; 24 pp.; In English
Report No.(s): AD-A474242; ERDE-2/R/50; No Copyright; Avail.: Defense Technical Information Center (DTIC)
A previous report E.R.D.E. No. 17/R/49 'Silver Azide as a replacement for lead azide in detonators' described experiments carried out on the preparation and properties of this substance and discussed its possible development as an initiator for Service detonators. The results justified the recommendations for further trials on performance and stability and also for the continued development of the method of preparation. As a result of these further investigations it is now possible to describe a detailed manufacturing process for silver azide; this is the object of the present report.
DTIC
Azides (Inorganic); Azides (Organic); Silver; Silver Compounds

20080003113 Explosives Research and Development Establishment, Waltham Abbey, UK
The Preparation and Properties of Diethylene Glycol Dinitrate. Part 4: The Continuous Process for DEGN Manufacture
Smith, S E; Nov 1949; 40 pp.; In English
Report No.(s): AD-A474257; ERDE-3/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The objective of the investigation was to examine the properties of diethylene glycol dinitrate and to develop a method for its manufacture from diethylene glycol.
DTIC
Dinitrates; Ethers; Glycols; Nitrates

20080003123 Florida Agricultural and Mechanical Univ., Tallahassee, FL USA
Cohesive Zone Approach to Multiscale Modeling of Nanotube Reinforced Composites
Chandra, Namas; Nov 18, 2007; 38 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0202; Proj-37-1906-041
Report No.(s): AD-A474286; FAMU-37099; No Copyright; Avail.: Defense Technical Information Center (DTIC)
This one year effort demonstrated that cohesive zone model can be adapted within a multi-scale approach to study the fracture behavior of carbon-nanotube (CNT) based polymer based composites. Some of the fundamental cohesive zone parameters like traction and displacement were computed using molecular dynamics and the results used in a non-linear finite element method to study the fracture characteristics of the CNT based composites. A new type of cohesive zone finite element was developed, and the element showed both numerical stability and accuracy. It was clearly shown using the developed method that unless the interface strength and fracture characteristics are properly controlled, the full capability of CNTs in composites could not be exploited. For example, simple carbon nano-fibers (a few micron in diameter) will outperform ONT based composites, if the former has better interface thermo-mechanical properties than the latter. Controlling atomic scale interfaces is however much more difficult and follow up work showed novel neutron bombardment and selective defect creation can achieve this. The present work paved way for breakthroughs in processing.
DTIC
Cohesion; Composite Materials; Nanotubes; Reinforcing Materials

20080003124 Explosives Research and Development Establishment, Waltham Abbey, UK
The Preparation and Properties of Diethylene Glycol Dinitrate. Part 5: Acid Recovery in the Manufacture of D.E.G.N
Smith, S E; Masterman, S; Turner, W E; Nov 1949; 25 pp.; In English
Report No.(s): AD-A474289; ERDE-4/R/49-PT-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Chemical Properties; Dinitrates; Ethers; Glycols; Nitration

20080003162 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Validation of the AFIT Small Scale Combustion Facility and OH Laser-Induced Fluorescence of an Atmospheric Laminar Premixed Flame

Koether, Stephen J; Sep 2007; 98 pp.; In English

Report No.(s): AD-A474372; AFIT/GAE/ENY/07-S03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Construction in the AFIT combustion facility is complete and the objective of this report is to explain the steps taken to make the laboratory operational. The infinite radius Ultra-Compact Combustor (UCC) sectional model has been delivered and is fully installed with all fuel, air and instrument lines. Every major system in the lab has been tested and is functioning properly. Laboratory operating procedure has been established to ensure both safety and continuity in experimental results. Finally, the lab has been certified through official safety channels and combustion experiments are underway. The unique capability of the AFIT combustion laboratory is the laser diagnostic system. The laser system has been configured for OH Laser-Induced Fluorescence (LIF) and initial experiments were performed on a premixed, laminar flame produced by a Hencken burner. The LIF methods accurately measured the OH concentration and temperature of the flame as compared to theoretical equilibrium flame data with an overall system uncertainty of approximately 2.5%. Therefore, the laser system has been calibrated and is ready for future use.

DTIC

Combustion Chambers; Flames; Laboratories; Laminar Flow; Laser Induced Fluorescence; Premixed Flames

20080003166 Naval Postgraduate School, Monterey, CA USA

Controllability of Non-Newtonian Fluids Under Homogeneous Flows

Wilson, Lynda M; Sep 2007; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474382; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The ability to control a viscoelastic field is an essential concept that defines some important restrictions and potentials of the influenced material. This thesis investigates the controllability of three popular constitutive models under homogeneous extensional and shear flows via the Lie bracket method. The constitutive models are as follows: the Phan-Thien-Tanner model; the Johnson-Segalman model; and the Doi model. The effect of extensional flow on these models and the effect of shear flow on the Doi model have not been explored previous to this work. The main contribution of this thesis is to characterize the submanifolds in the state space on which the non-Newtonian flow fields are weakly controllable. This kind of approach based on the control Lie algebra can be applied to a wider variety of complex models.

DTIC

Controllability; Homogeneity; Linear Systems; Nonnewtonian Fluids; Shear Flow; Viscoelasticity

20080003175 Naval Postgraduate School, Monterey, CA USA

Characterization of Graphite Lithium-Ion Cells

Moseley, Steven D; Sep 2007; 119 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474396; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores the characterization of graphite lithium-ion cells. A control procedure was performed to ensure any capacity loss or gain seen in tests was not the result of cell cycling. Vibration testing of the cells on all three axes to simulate the spacecraft launch environment showed a slight increase in capacity after vibration. Cell capacity was measured at two current rates at a variety of temperatures to obtain a family of curves to allow for a prediction of cell capacity at a given temperature. Voltage drift was explored and determined to not be a factor when matching cells for a battery. Using data from hard carbon lithium-ion cells, data for capacity loss over time while in storage was examined. It was determined that for an 18-month time period, these cells lost less than 2% of their capacity while in storage. Next, cells were cycled in simulated Low Earth Orbit power cycling to determine capacity loss while on orbit. Using a 0.25 Amp charge rate, the graphite cells retained 93% of their initial starting capacity by the 2000th cycle. Finally, cells underwent accelerated Low Earth Orbit testing to validate the accelerated testing theory. This thesis concludes that accelerated testing is not a good representation of how cells will perform under real time conditions.

DTIC

Flux Density; Graphite; Lithium; Lithium Batteries; Metal Ions; Storage Batteries

20080003184 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Carrier Lifetime Dynamics of Epitaxial Layer HVPE Gallium Arsenide Using Time-Resolved Experiments

Eikenberry, Wayne E; Mar 2006; 79 pp.; In English

Contract(s)/Grant(s): Proj-06351

Report No.(s): AD-A474407; AFIT/GAP/ENP/06-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

GaAs is a potential semiconductor material for producing both mid-infrared and terahertz radiation using the new technique of quasi-phase matching in an orientationally patterned GaAs (OP-GaAs) crystal. OP-GaAs is grown using a fast growth process called hydride vapor phase epitaxy (HVPE). Unfortunately, HVPE produces a high number of defects. These defects cause Shockley-Read-Hall recombination rates to dominate over Auger and radiative recombination rates. The carrier lifetime from four OP-GaAs samples are reported here using two different experimental techniques. The first experiment used a streak camera to measure the carrier lifetime via time-resolved photoluminescence. The temporal resolution of the streak camera can resolve the fast decay rate of the HVPE grown OP-GaAs samples. The second experiment used time-resolved pump-probe reflectivity to measure the carrier lifetime. This experiment used two laser beams; one was to excite the sample and the other was to measure the change in the index of refraction caused by the carrier excitation. The results of the lifetimes of these two experiment methods differ with each other.

DTIC

Carrier Lifetime; Charge Carriers; Epitaxy; Gallium Arsenides; Hydrides; Vapor Phase Epitaxy; Vapor Phases

20080003190 Korea Advanced Inst. of Science and Technology, Taejon, Korea, Republic of

Development of Advanced Oxide Dispersion Strengthened Tungsten Heavy Alloy for Penetrator Application

Hong, Soon H; Ryu, Ho J; Cha, Seung I; Kim, Hee Y; Kim, Kyung T; Lee, Kyong H; Mo, Chan B; Sep 30, 2005; 47 pp.; In English

Contract(s)/Grant(s): F62562-03-C0052

Report No.(s): AD-A474421; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The effects of fabrication process parameters, including conditions for powder preparation, sintering, cyclic heat-treatment, swaging, and annealing processes, on microstructures and static/dynamic mechanical properties of ODS tungsten heavy alloys were investigated. The composition of ODS tungsten heavy alloys was designed as 94W-4.56Ni-1.14Co-0.3Y₂O₃ which show the highest strength at similar microstructural parameters based on the analysis of microstructures and mechanical properties. The two-stage sintered ODS tungsten heavy alloy showed finer tungsten grain size than those prepared by conventional liquid phase sintering with similar matrix volume fraction and tungsten/tungsten contiguity. Cyclic heat-treatment process was introduced after sintering process to increase the tensile strength and elongation by decreasing the tungsten/tungsten contiguity. The swaging and annealing processes of ODS tungsten heavy alloy increase the tensile strength with decreasing the elongation. High strain rate dynamic compressive tests were performed by Hopkinson pressure bar test equipment. The dynamic compressive strength of ODS tungsten heavy alloys was improved by addition of oxide dispersoids and by modification of composition from W-Ni-Fe to W-Ni-Co. At the same time, the adiabatic shear bands induced by high strain rate dynamic shear tests became narrower by the dispersion of Y₂O₃ and by the composition modification. The 94W-4.56Ni-1.14Co-0.3Y₂O₃ alloy, which was two-stage sintered, cyclic heat-treated, swaged, and annealed, shows high ultimate tensile strength of 1350MPa, moderate elongation of 5% and high compressive yield strength of 1800MPa under a high strain rate deformation of 3000/s. The 94W-4.56Ni-1.14Co-0.3Y₂O₃ ODS tungsten heavy alloy has been suggested as an advanced core material for kinetic energy penetrators and hard target penetrators.

DTIC

Fabrication; Oxide Dispersion Strengthening; Oxides; Penetration; Tungsten Alloys

20080003353 West Virginia Univ., Morgantown, WV USA

Towards Fieldable Rapid Bioagent Detection: advanced Resonant Optical Waveguide and Biolayer Structures for Integrated Biosensing

Hornak, Lawrence A; Korakakis, Dimitris; Timperman, Aaron; Nov 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0815

Report No.(s): AD-A473931; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473931>

This research project established the understanding necessary for the stacked planar affinity-regulated resonant optical waveguide (SPARROW) architecture to serve as a transducer device platform for rapid biomolecular detection. SPARROW structures have been grown with waveguide losses of less than 1 dB/cm. Thin biolayers of less than 10 nm were achieved and

SAM attachment to polycrystalline surfaces studied. SPARROW transducer measurements were conducted using sucrose analyte solutions applied to the top waveguide surface via a PDMS microfluidic channel. For a flow channel and waveguide interaction width of 1200 microns, detection equivalent to a surface loading of from 10 to 1 pg/mm² was achieved under different SPARROW surface conditions. Achievable detection was modeled and indicated a Limit of Detection (LODs) lower than 0.1 pg/mm² for spore sized targets.

DTIC

Optical Waveguides; Biological Weapons; Biochemistry; Bioinstrumentation

20080005234 SRI International Corp., Menlo Park, CA USA

High Intensity Light Propagation In InAs (Postprint)

Guha, Shekhar; Gonzalez, Leo; Jun 2006; 6 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474509; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present our experimental and theoretical results on nonlinear absorption of light in InAs. The nonlinear variation of output intensity as a function of input intensity and time are calculated by solving four coupled rate equations simultaneously. All required quantities, including two-photon absorption, free-carrier absorption, Auger and radiative recombination lifetimes, and intrinsic carrier densities, have been obtained from the underlying bandstructures. The calculated thickness and energy-dependent output intensities in InAs agree very well with the values measured in our pump-probe experiments.

DTIC

Indium Arsenides; Light Transmission; Nonlinearity; Photons

20080005364 Air Force Research Lab., Wright-Patterson AFB, OH USA

Holographic Polymer Dispersed Liquid Crystal (HPDLC) Transmission Gratings Formed by Visible Light Initiated Thiol-Ene Photopolymerization (Postprint)

Wofford, Jeremy M; Bunning, Timothy J; Natarajan, Lalgudi V; Tondiglia, Vincent P; Sutherland, Richard L; Siwecki, Stephen A; Lloyd, Pamela F; Oct 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474687; AFRL-ML-WP-TP-2007-529; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We report on the initial development of a visible initiator for thiol-ene photopolymerization using the 647 nm radiation from a Krypton ion laser. The photoinitiator system consists of the dye oxazine 170 perchlorate and the co-initiator benzoyl peroxide. Electron transfer occurs between the singlet excited state of the oxazine dye and benzoyl peroxide with subsequent decomposition of the peroxide yielding benzoyl oxy radicals capable of free radical initiation. We demonstrate that this photoinitiation system enables holographic patterning of HPDLC gratings as initial Bragg transmission gratings with a periodicity less than one micron using 647 nm radiation. These gratings were electrically switchable between a diffractive and transmissive state. Morphology studies using bright field transmission electron microscopy (BFTEM) indicate the phase separation of nearly spherical shaped nematic liquid crystal droplets of several hundred nanometers in diameter. This demonstration suggests that reflection gratings can be written using this photoinitiator system and 647 nm radiation which have switchable notch wavelengths approaching 2 microns.

DTIC

Holography; Liquid Crystals; Photopolymers; Polymerization; Thiols

20080005387 Aerospace Corp., El Segundo, CA USA

Measured Leak Rate of Ammonia Through an Epoxy/Stainless-Steel Patch

Brady, B B; Desain, J D; Curtiss, T J; Aug 10, 2007; 20 pp.; In English

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A474731; TR-2007(1466)-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A program has experienced pitting corrosion in anhydrous ammonia-charged loop heat pipes. Areas of each loop heat pipe with increased risk of pitting corrosion were previously identified with X-ray image analysis and patched with a formed stainless-steel cap, bonded with a space-approved epoxy. To assess the lifetime of the patch and sensitivity to manufacturing variation, simulated leaks in circular aluminum discs were patched with several different variants on the same epoxy-stainless materials system. The patches were aged at elevated temperature to accelerate degradation phenomena. No gross failures of the patches were observed in four weeks of testing. No significant difference was observed between the aged bonded material

at 353K, 393K, or a freshly prepared patch. Infrared detection of ammonia leaking through the patch suggests that a loss rate of 0.16 +/- 0.04 mg of ammonia per year will occur through the simulated leaks with primed patches.

DTIC

Ammonia; Epoxy Resins; Heat Pipes; Leakage; Stainless Steels

20080005603 Vijay Kumar Foundation, Chennai, India

First Principles Modeling of Segregation of Nd to YAG Grain Boundaries

Kumar, Vijay; Nov 15, 2007; 17 pp.; In English

Contract(s)/Grant(s): FA5209-06-P-0137

Report No.(s): AD-A474728; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474728>

Calculations show that Nd doping in bulk is endothermic and it agrees with experiments which show that only a very small amount can be added in bulk. However, there is a large segregation energy on surface and Nd doping is energetically favorable. An interesting finding is that Al replacement by Nd at the surface is highly exothermic. We expect similar trends on grain boundaries though segregation energies will be lower.

DTIC

Additives; Rare Earth Elements; Yttrium-Aluminum Garnet

20080005633 Colorado Univ., Boulder, CO USA

Radar Absorbing Colloidal Solutions (RACS)

Stoldt, Conrad; Stowell, Michael H; Popovic, Zoya; Pisano, Albert P; Walther, David C; Aug 2007; 16 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0002

Report No.(s): AD-A474806; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474806>

Lastly, studies were directed toward the development and modeling of colloid containing microfluidics for the active modulation of microwave absorption. A method for the self-pumping of immiscible fluids was developed and a numerical model was formulated to estimate liquid flow rates in the microchannels as a function of different parameters including device dimensions and fluid properties. Initial work also focused on the development of non-lossy injection molded microfluidic platforms fabricated from Teflon.

DTIC

Absorption; Colloids; Microwaves

20080005634 Cornell Univ., Ithaca, NY USA

Nanoscale Ionic Liquids

Giannelis, Emmanuel P; Lee, Dongkyu; Burgaz, Engin; Wang, Dongyan; Nov 2006; 10 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0012

Report No.(s): AD-A474807; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474807>

The focus of this program was a new family of solvent-less nanoparticle fluids (hereafter referred to as nanoparticle fluids, NFs) comprised of a charged corona grafted to various nanoparticle cores. NFs possess flow properties (viscosity and diffusivity) remarkably similar to simple molecular liquids even in the absence of any diluent or solvent. Additionally, unlike molecular liquids, NFs do not possess a measurable vapor pressure dramatically increasing the range of potential applications. Furthermore, since NFs are hybrid systems, they can be engineered to combine specific properties (e.g. conductivity, magnetic susceptibility, refractive index, photoluminescence) that are difficult or impossible to achieve with molecular-based liquids. These new materials offer new and unique opportunities because their physical properties can be manipulated over a wide range, from liquid to solid, by varying the size and concentration of the nanoparticles as well as the temperature. The fluid character at low temperatures especially in the absence of solvents facilitates many new applications where conventional colloidal suspensions either cannot be used or require special design to reduce solvent loss. Applications of potential interest to the Air-Force include lubricants for deployed space systems and MEMS, alternative coolants for thermal management applications, electrolytes for high-temperature fuel cells/batteries, ferrofluids for actuators, compliant electrodes, zero VOC inks for microfabrication, and high refractive index liquids.

DTIC

Flow; Liquids; Nanostructures (Devices); Phase Transformations

20080005635 State Univ. of New York, Buffalo, NY USA

Performance Optimization of Fe-Based Light Emitting Diodes

Petrou, Athos; Dec 10, 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0564; Proj-06PR07174-01

Report No.(s): AD-A474808; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474808>

We have evaluated the performance of a new type of Fe spin-LED in which recombination takes place in InAs monolayers grown at the intrinsic region of an n-i-p AlGaAs(n)/GaAs(i)/AlGaAs(p) diode. The intrinsic region is a wide GaAs quantum well. The InAs layer is known as the 'wetting layer' (WL). The new WL spin-LEDs were found to have the same high circular polarization as the more conventional Fe spin-LEDs, but differ in one very important aspect: They are one order of magnitude brighter than their conventional counterparts. As a result, the WL spin-LEDs function reliably at room temperature (the conventional spin-LEDs don't).

DTIC

Aluminum Gallium Arsenides; Injection; Light Emitting Diodes; Optimization; Quantum Wells

20080005666 Dow Corning Compound Semiconductor Solutions, LLC, Midland, MI USA

Known Good Substrates Year 1

Loboda, Mark; Carlson, Eric; Chung, Gilyong; Russell, Brian; Dec 5, 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0324

Report No.(s): AD-A474816; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Known Good Substrates (KGS) Phase I program is complete. Results are reported for the entire program, including subcontractor activities.

DTIC

Semiconductors (Materials); Silicon Carbides; Substrates

20080005793 Naval Research Lab., Washington, DC USA

Study of the Implications of Whitecap Intermittency on the Uniform Sea-salt Aerosol Source Approximation and Deposition Velocity

Hoppel, William A; Caffrey, Peter F; Oct 29, 2007; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474497; NRL/MR/7220--07-9086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The source function and deposition velocity of sea-salt particles used in large-scale models assumes that the source and deposition is uniform over areas large compared to the horizontal grid spacing of the model, whereas sea-salt aerosol is overwhelmingly generated by white caps whose surface distribution is usually sparse and sporadic. The analysis presented here uses several puff plume models to study the validity of the underlying assumptions of the horizontally uniform surface source and deposition, and a time series of puff plumes is averaged to obtain the large-scale source and deposition flux. The analysis demonstrates the remarkable difference between (i) the case where deposition results exclusively from non-gravitational deposition processes at the surface (i.e., small particles) and (ii) the case where deposition is solely from gravitational settling (i.e., large particles). For Case (i), the magnitude of the gradient (eddy correlation) flux, initially equal to the source flux, will evolve to an equilibrium state where there is no gradient flux. This can be contrasted to Case (ii) where the upward gradient flux is always equal to the source flux (at a given height) and the transient behavior is governed by the increase of the gravitational flux during the transition to equilibrium (upward gradient (source) flux equals the downward deposition flux). The intermediate case where both the gravitational and deposition fluxes are important is a mixture of the above two cases.

DTIC

Aerosols; Deposition; Flux (Rate); Intermittency; Seas; Water

20080005836 Naval Research Lab., Washington, DC USA

Liquid Crystal Technology for Adaptive Optics: an Update

Restaino, Sergio R; Payne, Don M; Baker, Jeff T; Andrews, Jonathan R; Teare, Scott W; Gilbreath, G C; Dayton, Dave; Gonglewski, John; Jan 2003; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474938; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The idea of using liquid crystal (LC) devices as an adaptive optics component has been proposed by several authors. In

recent years a vigorous research effort has been carried out, and it is still flourishing, in several countries. Mainly the research and experimental work has been concentrated in the USA, U.K. and Russia. There are several reasons why liquid crystals may represent a valid alternative to the traditional deformable mirror technology that has been used for the past two decades or so. The main attractiveness of LC resides in the cost. Current deformable mirror technology has a range of price going from \$2K to \$15K per channel. LC technology promises to be at least a couple of orders of magnitude cheaper. Other reasons are connected with reliability, low power consumption and with a huge technological momentum based on a wide variety of industrial applications. In this paper we present some preliminary characterizations of a new, large format device. Such devices have the potential for extremely high-resolution wave-front control due to the over 10,000 corrective elements. The characterization of the device, so far, consists of measurements of the overall optical quality and of the phase control relationship.

DTIC

Adaptive Optics; Liquid Crystals

20080006067 NASA Glenn Research Center, Cleveland, OH, USA

Synthesis of Novel Rod-Coil Polyimide Gel Electrolytes for Lithium Batteries that Are Cured at Ambient Temperature

Tigelaar, Dean M.; Parker, Allyson E.; Meador, Mary Ann B.; Bennett, William R.; [2008]; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNC062A46A; WBS 561581.02.08.03.15.03; Copyright; Avail.: Other Sources

A highly crosslinked polyimide-poly(ethylene oxide) copolymer has been synthesized that is capable of holding large volumes of liquid component while maintaining good dimensional stability. An amine endcapped oligomer was made that was imidized in solution, followed by reaction with a triisocyanate in the presence of desired additives at ambient temperature. Polymer films are able to hold over 4 times their weight in room temperature ionic liquid (RTIL) or carbonate solvent. Films with a high liquid component and doped with lithium trifluoromethanesulfonimide (LiTFSi) are highly conductive. Initial tests show the RTIL-containing electrolyte is stable toward galvanic cycling between lithium metal electrodes at 60 C and 0.25 mA/cm² current density.

Author

Ambient Temperature; Electrolytes; Gels; Lithium Batteries; Synthesis (Chemistry); Polyimides; Curing

20080006070 NASA Glenn Research Center, Cleveland, OH, USA

The Application of Metal Oxide Nanomaterials for Chemical Sensor Development

Xu, Jennifer C.; Hunter, Gary W.; Evans, Laura J.; VanderWal, Randy L.; Berger, Gordon M.; December 11, 2007; 18 pp.; In English; Sensors World Conference, 11-13 Dec. 2007, Williamsburg, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 645846.02.07.04.04.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA Glenn Research Center (GRC) has been developing miniature chemical sensors for a variety of applications including fire detection, emissions monitoring, fuel leak detection, and environmental monitoring. Smart Lick and Stick sensor technology which integrates a sensor array, electronics, telemetry, and power into one microsystem are being developed. These microsystems require low power consumption for long-term aerospace applications. One approach to decreasing power consumption is the use of nanotechnology. Nanocrystalline tin oxide (SnO₂) carbon monoxide (CO) sensors developed previously by this group have been successfully used for fire detection and emissions monitoring. This presentation will briefly review the overall NASA GRC chemical sensor program and discuss our further effort in nanotechnology applications. New carbon dioxide (CO₂) sensing material using doped nanocrystalline SnO₂ will be discussed. Nanocrystalline SnO₂ coated solid electrolyte CO₂ sensors and SnO₂ nanorod and nanofiber hydrogen (H₂) sensors operated at reduced or room temperatures will also be discussed.

Author

Metal Oxides; Miniaturization; Nanotechnology; Sensors; Fabrication; Synthesis (Chemistry)

20080006077 Air Force Research Lab., Wright-Patterson AFB, OH USA

Electro-Optic Properties of Holographically Patterned, Polymer Stabilized Cholesteric Liquid Crystals (Preprint)

Beckel, Eric R; Natarajan, Lalgudi V; Tondiglia, Vincent P; Sutherland, Richard L; Bunning, Timothy J; Jan 2007; 28 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474958; AFRL-ML-WP-TP-2007-518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474958>

Electro-optic properties of cholesteric liquid crystals with holographically patterned polymer stabilization were examined. It is hypothesized that increasing the LC domain size in a single dimension, relative to a random 3-D network of LC pockets separated by polymer strands, will allow for enhanced electro-optic properties of the final device. Prior to holographic patterning, polymer stabilization with large elastic memory was generated by way of high irradiation intensities and optimized material choices. High irradiation intensities are required for the holographic patterning process to maintain polymer layer formation. At optimized conditions, polymer patterning of the stabilization allowed for an approximate 20% increase in the clear state transmission of the device, and allowed for 3 Vmicron reduction in the overall switching voltage as compared to an analogous floodlit irradiated sample. Switching times were increased at most three-fold with holographic patterning, but all relaxation times were below 20 ms. These enhanced electro-optic properties appear to stem from a single dimension domain size increase, which allows for a reduction in the LC/polymer interaction.

DTIC

Cholesterol; Electro-Optics; Holography; Liquid Crystals

20080006080 Air Force Research Lab., Wright-Patterson AFB, OH USA

Mechanism of Hydrogen Production in [Fe-Fe]-Hydrogenase: A Density Functional Theory Study (Preprint)

Trohalaki, Steven; Pachter, Ruth; Mar 2007; 40 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474961; AFRL-ML-WP-TP-2007-512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474961>

[Fe-Fe]-hydrogenases are a class of metalloenzymes that catalyze the production of H₂ from two protons and two electrons. In this work, we used density functional theory (DFT) calculations to analyze the mechanism of hydrogen production, providing insight into the role of the intermediates in the catalysis. We also validated the exchange-correlation functional applied within DFT for model compounds of the active site in [Fe-Fe]-hydrogenase, enabling us a reliable application for understanding previously established hydrogen production hypotheses, as well as providing a starting point for a future investigation of the effects of the protein environment on the catalytic mechanism of [Fe-Fe]-hydrogenases.

DTIC

Catalysis; Density Functional Theory; Hydrogen; Hydrogen Production

20080006081 Air Force Research Lab., Wright-Patterson AFB, OH USA

Optical Tuning of the Reflection of Azobenzene Liquid Crystal Doped Cholesterics (Preprint)

Hrozhyk, Uladzimir A; Serak, Svetlana V; Tabiryan, Nelson V; Bunning, Timothy J; Apr 2007; 43 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474962; AFRL-ML-WP-TP-2007-513; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474962>

Mixtures of cholesteric liquid crystals doped with high clearing temperature azobenzene nematic liquid crystals are shown to possess large, fast, and reversible dynamic photosensitive features. Selective wavelengths shifts approaching 400 nm are reported and depending on the host cholesteric liquid crystal, both red-shifted and blue-shifted wavelength changes can be induced. The photoinduced states of these material systems are shown to be stable for long periods of time upon removal of the radiation source, completely reversible, and dynamically fast. These phototunable features were demonstrated using both CW and nanosecond laser beams. The latter was used to change the selective reflection wavelength from blue to green with a single nanosecond pulse and the ability to write information into these films using these processes were demonstrated.

DTIC

Doped Crystals; Liquid Crystals; Optical Reflection; Photosensitivity; Tuning

20080006082 Air Force Research Lab., Wright-Patterson AFB, OH USA

All-Optical, Photonic Band Gap Modulation in Azobenzene Liquid Crystal Doped Cholesterics (Preprint)

Hrozhyk, Uladzimir A; Serak, Svetlana V; Tabiryman, Nelson V; Bunning, Timothy J; Oct 2006; 30 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474963; AFRL-ML-WP-TP-2007-506; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474963>

Cholesteric liquid crystals doped with high clearing temperature azobenzene liquid crystals are shown to possess large, fast, and reversible dynamic photosensitive features. Selective wavelengths shifts approaching 400 nm are reported and depending on the host cholesteric liquid crystal, both red-shifted and blue-shifted wavelength changes can be induced. The photoinduced states of these material systems are shown to be stable for long periods of time upon removal of the radiation source, completely reversible, and dynamically fast. These phototunable features were demonstrated using both CW and nanosecond laser beams. The latter was used to change the selective reflection wavelength from blue to green with a single nanosecond pulse and the ability to write information into these films using these processes were demonstrated.

DTIC

Doped Crystals; Energy Gaps (Solid State); Liquid Crystals; Modulation; Photosensitivity

20080006084 Air Force Research Lab., Wright-Patterson AFB, OH USA

Polymer Film with Optically Controlled Form and Actuation (Preprint)

Tabiryman, Nelson; Serak, Svetlana; Dai, Xio-Man; Bunning, Timothy J; Sep 2006; 6 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474968; AFRL-ML-WP-TP-2007-505; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474968>

Polymer networks containing azobenzene liquid-crystalline (azo LC) moieties are capable of changing their macroscopic shape when influenced by light. Two distinct processes take place in azo LCs due to the photoisomerization of the azobenzene chromophores. Trans-cis isomerization and thus a reduced order parameter is dominant at UV wavelengths whereas trans-cis-trans isomerization processes are dominant at visible wavelengths resulting in orientation of the molecules perpendicular to the beam polarization.

DTIC

Crystallinity; Liquid Crystals; Polymeric Films

20080006089 Air Force Research Lab., Wright-Patterson AFB, OH USA

Asymmetry in Platinum Acetylide Complexes: Confinement of the Triplet Exciton to the Lowest Energy Ligand (Preprint)

Cooper, Thomas M; Krein, Douglas M; Burke, Aaron R; McLean, Daniel G; Rogers, Joy E; Slagle, Jonathan E; Aug 2006; 49 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474973; AFRL-ML-WP-TP-2007-530; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474973>

As part of an ongoing investigation of structure-optical property relationships in platinum acetylide complexes, we synthesized the compounds trans-Pt(PBU3)2(C=CC6HS)(C=C-C6H4-C=CC6HS)(PE 1-2), trans-Pt(PBU3h(C=CC6HS)(C=CC6H4-C=C-C6~C=CC6HS)(PE1-3) and trans-Pt(PBU3h(C=C-C6~C=CC6HS)(C=CC6H4-C=C-C6H4-C=CC6HS)(PE2-3) that have different ligands on either side of the central platinum and compared their spectroscopic properties to the symmetrical compounds PE1, PE2 and PE3. We measured trends in ground state absorption, fluorescence, phosphorescence and triplet state absorption spectra. We also performed density functional theory calculations of the triplet state geometries and energies. The ground state absorption and fluorescence spectra give evidence the singlet exciton is delocalized across the central platinum atom. In contrast, the behavior of the phosphorescence spectra suggests the triplet exciton is confined to one ligand. The phosphorescence from the asymmetric complexes comes from the lowest energy, most delocalized ligand. The triplet state geometries obtained from the density functional theory calculations show distortion on the lowest energy ligand, while the other ligand has the ground state geometry. The calculated trend in the triplet state energies agrees very well with the experimental trend. Calculations of triplet state spin density also show the triplet exciton is confined to one ligand. In the asymmetric complexes the spin density is confined to the more conjugated, lower energy ligand. The

results show Kasha's rule applies to these complexes, where following excitation and intersystem crossing, the triplet exciton moves to the lowest energy ligand.

DTIC

Acetylene; Asymmetry; Atomic Energy Levels; Confinement; Excitons; Ligands; Optical Properties; Phosphorescence; Platinum

20080006096 Air Force Research Lab., Wright-Patterson AFB, OH USA

Self-Pumped Photorefractive Gratings in Fe:KNbO₃ (Preprint)

Evans, Dean R; Gook, G; Carns, J L; Saleh, M A; Jan 2006; 16 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474989; AFRL-ML-WP-TP-2007-523; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474989>

*High gain confirmed in off-axis geometries for Fe:KNbO₃; *Mismatch between theory and experiment for mid-range crystal angles, especially for the a-c plane; *Large apparent variation in the effective trap density with crystal angle; *Modified theory gives a good fit to experimental data; *Mechanism for trap density anisotropy is unclear.

DTIC

Iron; Niobium; Potassium

20080006112 Air Force Research Lab., Wright-Patterson AFB, OH USA

Liquid Crystal Bragg Gratings: Dynamic Optical Elements for Spatial Light Modulators (Preprint)

Sutherland, Richard L; Tondiglia, Vincent P; Natarajan, Lalgudi V; Wofford, Jeremy M; Siwecki, Stephen; Cook, Gary; Evans, Dean R; Lloyd, Pamela F; Bunning, Timothy J; Jan 2007; 18 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475012; AFRL-ML-WP-TP-2007-514; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475012>

Bragg gratings yield a single diffracted order when irradiated by a coherent beam at the appropriate Bragg angle. In many cases, nearly all of the energy of the incident beam can be coupled to the diffracted beam. Hence these gratings can form many useful optical elements, and this has been realized in 1-D, 2-D, and 3-D photonic crystals. Bragg gratings made with liquid crystals offer the added dimension of dynamic properties through the large electro-optical effect in liquid crystals. Applications for spatial light modulators are numerous, including optical switches, modulators, active optical elements (e.g., lenses), laser sources, and tunable filters. We have been exploring a number of approaches for making liquid crystal Bragg gratings, including holographic polymer-dispersed liquid crystals, cholesteric liquid crystals, and homogenous nematic liquid crystals in hybrid devices. We have studied the dynamic properties of these Bragg gratings by electrical, thermal, and optical stimulation. Modification and control of optical and dynamic properties have been obtained through combinations of liquid crystals with polymers, combinations of various dopant materials, and interactions of liquid crystals with organic and inorganic interfaces. We discuss the materials, fabrication, characterization, and physics of liquid crystal Bragg gratings and present the results of various devices we have studied in our lab. We will also discuss potential applications.

DTIC

Bragg Angle; Light Modulators; Liquid Crystals

20080006116 Purdue Univ., West Lafayette, IN USA

Enhanced Laser System for Two-Point Scalar Time-Series Measurements in Turbulent Partially Premixed Flames

King, Galen B; May 15, 2007; 9 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0350; Proj-5094

Report No.(s): AD-A475017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475017>

Picosecond time-resolved laser-induced fluorescence (PITLIF) has been shown to be a valuable tool for turbulent combustion research. The laser system enhancement enabled by this grant has significantly increased the range of systems that may be studied utilizing the PITLIF method. The enhanced laser system has increased the frequency tripled laser power by nearly an order of magnitude from 35 mW for the previous system to over 300 mW for the current system (at 306.5 nm). Additionally, pump laser noise has been decreased by over -40 dB in a similar comparison. The enhanced system has allowed

a range of combustion systems of interest to the Air Force to be studied, including thermoacoustic instabilities and partially premixed turbulent combustion.

DTIC

Combustion; Diagnosis; Flames; Laser Induced Fluorescence; Lasers; Premixed Flames; Scalars; Time Series Analysis; Turbulence; Turbulent Combustion; Turbulent Flames

20080006129 Air Force Research Lab., Wright-Patterson AFB, OH USA

Experimental and Computational Characterization of Combustion Phenomena

Gord, James R; May 2006; 61 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A475046; AFRL-PR-WP-TM-2006-2131; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475046>

Propulsion systems represent a substantial fraction of the cost, weight, and complexity of Air Force aircraft, spacecraft, and other weapon-system platforms. The vast majority of these propulsion systems are powered through combustion of fuel; therefore, the detailed study of combustion has emerged as a highly relevant and important field of endeavor. Much of the work performed by today's combustion scientists and engineers is devoted to the tasks of improving propulsion-system performance while simultaneously reducing pollutant emissions. Increasing the affordability, maintainability, and reliability of these critical propulsion systems is a major driver of activity as well. This research effort is designed to forward the scientific investigation of combustion phenomena through an integrated program of fundamental combustion studies, both experimental and computational, supported by parallel efforts to develop, demonstrate, and apply advanced techniques in laser-based/optical diagnostics and modeling and simulation.

DTIC

Combustion; Combustion Physics; Diagnosis; Lasers; Models; Propulsion System Configurations; Propulsion System Performance

20080006130 Illinois Univ., Chicago, IL USA

Absorption of Narrow Gap HgCdTe Near the Band Edge Including Nonparabolicity and the Urbach Tail (Preprint)

Chang, Yong; Grein, Christoph H; Sivananthan, S; Guha, Shekhar; Velicu, S; Flatte, M E; Nathan, V; Jan 2007; 25 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475048; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475048>

An analytical model describing the absorption behavior of Hg_{1-x}Cd_xTe is developed. It simultaneously considers the contributions from non-parabolic conduction/light hole bands and parabolic heavy hole bands obtained from 14-band k·p electronic structure calculations as well as the Urbach tail. This model smoothly fits experimental absorption coefficients over energies ranging from the Urbach tail region to the intrinsic absorption region up to at least 300 me V above the band gap.

DTIC

Absorptivity; Band Structure of Solids; Mercury Cadmium Tellurides; Photons

20080006131 Army Research Lab., Adelphi, MD USA

Reducing Film Thickness in Lead Zirconate Titanate Thin Film Capacitors

Rao, Vikram; Polcawich, Ronald G; Dec 2007; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475049; ARL-TR-4338; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475049>

The goal of this project is to characterize the dielectric and ferroelectric performance of lead zirconate titanate (PZT) thin film capacitors as a function of film thickness and sol-gel solution composition. For the thickness experiments, the underlying silicon dioxide, platinum electrode, and the spin-deposited PZT thicknesses were varied. For the solution tests, the molarity and the zirconium/titanium ratio was also varied. In addition, PZT spin rate was varied to determine the spin rate's effect on PZT thickness and dielectric and ferroelectric properties. Both capacitance and hysteresis data were taken for all samples. This project will aid the Defense Advanced Research Projects Agency (DARPA) nanoelectromechanical switch (NEMS) program

by investigating avenues of reducing film thickness while maintaining acceptable levels of performance.
DTIC

Capacitors; Film Thickness; Lead Zirconate Titanates; Thin Films

20080006132 Purdue Univ., West Lafayette, IN USA

Electrical, Structural, and Optical Properties of Cr-Doped and Non-Stoichiometric V₂O₃ Thin Films (Preprint)

Metcalf, Patricia A; Gonzalez, Leonel P; Barnes, Jacob O; Slamovich, Elliott; Guha, Shekhar; Honig, Jurgen M; Jun 2006; 23 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475050; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475050>

V₂O₃ films and Cr-doped V₂O₃ films were grown on (0001) (C-plane) and (1120) (plane) oriented sapphire substrates by the reduction of sol-gel derived vanadium oxide films. Examination by x-ray diffraction, SEM, TEM, and atomic force microscopy showed the films to be comprised of highly oriented grains. Optical transmission and dc resistivity measurements revealed phase transitions characteristic of the single crystal V₂O₃ and Cr-doped V₂O₃. Subsequent anneals of the un-doped films under controlled oxygen atmospheres yielded non-stoichiometric films with metal-insulator transitions characteristic of annealed V₂O₃ single crystals.

DTIC

Doped Crystals; Electrical Properties; Optical Properties; Phase Transformations; Stoichiometry; Thin Films; Vanadium Compounds

20080006269 Air Force Research Lab., Wright-Patterson AFB, OH USA

New Phenomena in Dye-Doped Liquid Crystals: Black Hole Effect and Switchable Reversed Diffraction (Postprint)

Evans, D R; Cook, G; Saleh, M A; Carns, J L; Serak, S; Tabiryan, N; Jan 2006; 17 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475113; AFRL-ML-WP-TP-2007-545; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A nonlinear extinction of transmitted light is observed in liquid crystal cells with large concentrations of anthraquinone dye. Two distinct mechanisms are responsible for this effect when exposed to low and high intensity light, respectively. At low intensities, critical opalescence, micro-scatter, and an increase in linear absorption occur; whereas high intensities result in scattering from photo-induced micro-bubbles.

DTIC

Black Holes (Astronomy); Diffraction; Doped Crystals; Dyes; Liquid Crystals; Nonlinear Optics

20080006302 Dow Chemical Co., Midland, MI USA

Q1 Known Good Substrates Technical Report

Jan 3, 2008; 7 pp.; In English

Contract(s)/Grant(s): N00014-07-C-0918

Report No.(s): AD-A475167; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Known Good Substrates (KGS) Phase II program was initiated 1 September 2007. There was a delay between the Phase I program end of over 6 months. All Phase II subcontractors were under contract by December 2007. Appendix 1 shows the subcontractors and their focus areas in the program.

DTIC

Metrology; Silicon Carbides; Substrates

20080006306 Drexel Univ., Philadelphia, PA USA

On the Structure of Holographic Polymer-Dispersed Polyethylene Glycol (Postprint)

Birnkrant, Michael J; McWilliams, Hilary K; Li, Christopher Y; Natarajan, Lalgudi V; Toodiglia, Vincent P; Sutherland, Richard L; Lloyd, Pamela F; Bunning, Timothy J; Oct 2006; 11 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475177; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Holographic polymerization (H-P) has been used to fabricate polymer-dispersed liquid crystals and pattern inert nanoparticles. In this article, one-dimensional grating structures of Norland resin and polyethylene glycol (PEG) were

achieved using the H-P technique. Both reflection and transmission grating structures were fabricated. The optical properties of the reflection grating structures (also known as Bragg reflectors, BRs) are thermosensitive, which is attributed to the formation and crystallization of PEG crystals. The thermal switching temperature of the BR can be tuned by using different molecular weight PEG samples. The hierarchical structure and morphology of the BR were studied using synchrotron X-ray, polarized light microscopy and transmission electron microscopy. PEG crystals were found to be confined in w60 nm thick layers in the BR. Upon crystallization, the PEG lamellae were parallel to the BR surfaces and PEG chains were parallel to the BR normal, resembling the confined crystallization behavior of polyethylene oxide (PEO) in PEO-block-polystyrene (PEO-b-PS) block copolymers. This observation suggests that the tethering effect in the block copolymer systems does not play a major role in PEG chain orientation in the confined nanoenvironment.

DTIC

Glycols; Holography; Liquid Crystals; Polyethylenes; Polymerization

20080006313 Air Force Research Lab., Wright-Patterson AFB, OH USA

Electrical, Structural, and Optical Properties of CR-Doped and Non-Stoichiometric V2O3 Thin Films (Postprint)

Metcalf, Patricia A; Guha, Shekhar; Gonzalez, Leonel P; Barnes, Jacob O; Slamovich, Elliott B; Honig, Jurgen M; Jun 2006; 8 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Using accurate band structures of InAs, InSb, and two Hg_{1-x}Cd_xTe alloys, we calculate the change in refractive index caused by the photoexcited electrons and holes. The effects of both free-carrier absorption (FCA) and one-photon absorption are considered. We find that the change in refractive index varies nonlinearly with the density of photoexcited carriers and that the generally neglected FCA contribution is significant in InAs, owing to its weak spin-orbit coupling. V2O3 films and Cr-doped V2O3 films were grown on (0 0 0 1) (C-plane) and (1 1 2 0) (A-plane) oriented sapphire substrates by the reduction of sol-gel derived vanadium oxide films. Examination by X-ray diffraction, scanning electron microscopy, transmission electron microscopy, and atomic force microscopy showed the films to be comprised of highly oriented grains. Optical transmission and resistivity measurements revealed phase transitions characteristic of the single crystal V2O3 and Cr-doped V2O3. Subsequent anneals of the un-doped films under controlled oxygen atmospheres yielded non-stoichiometric films with metal-insulator transitions characteristic of annealed V2O3 single crystals.

DTIC

Chromium; Doped Crystals; Electrical Properties; Electron Microscopy; Optical Properties; Stoichiometry; Thin Films; Vanadium Oxides

20080006336 Air Force Research Lab., Edwards AFB, CA USA

Perspective on One Decade of Laser Propulsion Research at the Air Force Research Laboratory (Preprint)

Larson, C W; Nov 28, 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-33SP

Report No.(s): AD-A475260; AFRL-RZ-ED-TP-2007-515; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Air Force Laser Propulsion Program spanned nearly 10-years and included about 35-weeks of experimental research with the Pulsed Laser Vulnerability Test System of the High Energy Laser Systems Test Facility at White Sands Missile Range, New Mexico, WSMR/HELSTF/PLVTS. PLVTS is a pulsed CO₂ laser that produces up to 10 kW of power in -10 cm² spot at wavelength of 10.6 microns. The laser is capable of a pulse repetition rate up to 25 Hz, with pulse durations of about 20 microseconds. During the program basic research was conducted on the production of propulsion thrust from laser energy through heating of air and ablation of various candidate rocket propellant fuels. Flight tests with an ablation fuel (Delrin) and air were accomplished with a model Laser Lightcraft vehicle that was optimized for propulsion by the PLVTS at its maximum power output, 10kW at 25 Hz, 400 J/pulse. Altitudes exceeding 200-feet were achieved with ablation fuels. The most recent contributions to the technology included development of a mini-thruster standard for testing of chemically enhanced fuels and theoretical calculations on the performance of formulations containing ammonium nitrate and Delrin. Results of these calculations will also be reported here.

DTIC

Energy Conversion; Laser Propulsion; Lasers; Military Technology; Propulsion System Configurations; Propulsion System Performance; Research and Development

20080006495 NASA Langley Research Center, Hampton, VA, USA

Electrochemically Controlled Reconstitution of Immobilized Ferritins for Bioelectronic Applications

Kim, Jae-Woo; Choi, Sang H.; Lillehei, Peter T.; Chu, Sang-Hong; King, Glen C.; Watt, Gerald D.; [2007]; 29 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08

Report No.(s): LAR-16846-1; Copyright; Avail.: CASI: [A03](#), Hardcopy

Site-specific reconstituted nanoparticles were fabricated via electrochemically-controlled biomineralization through the immobilization of biomolecules. The work reported herein includes the immobilization of ferritin with various surface modifications, the electrochemical biomineralization of ferritins with different inorganic cores, and the electrocatalytic reduction of oxygen on the reconstituted Pt-cored ferritins. Protein immobilization on the substrate is achieved by anchoring ferritins with dithiobis-N-succinimidyl propionate (DTSP). A reconstitution process of site-specific electrochemical biomineralization with a protein cage loads ferritins with different core materials. The ferritin acts as a nano-scale template, a biocompatible cage, and a separator between the nanoparticles. This first demonstration of electrochemically controlled site-specific reconstitution of biomolecules provides a new tool for biomineralization and opens the way to produce the bio-templated nanoparticles by electrochemical control. The nanosized platinum-cored ferritins on gold displayed good catalytic activity for the electrochemical reduction of oxygen, which is applicable to biofuel cell applications. This results in a smaller catalyst loading on the electrodes for fuel cells or other bioelectronic devices.

Author

Immobilization; Biochemistry; Electrocatalysts; Catalytic Activity; Nanoparticles; Proteins

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METALS AND METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals and metallic materials; and metallurgy.

20080003324 Naval Postgraduate School, Monterey, CA USA

Aging Effects on Microstructure and Creep in Sn-3.8Ag-0.7Cu Solder

Cornejo, Orlando; Sep 2007; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473973; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473973>

Solder joints provide mechanical and electrical interconnections between electronic devices and packaging substrates in electronics applications. The different coefficient of thermal expansion (CTE) between substrate, silicon device and solder imposes strains on the solder joint. Creep constitutes the primary deformation mechanism, limiting the low cycle fatigue life of solder joint. The trend toward miniaturization, higher service temperatures, and higher current densities and the transition to lead-free solders, which possess higher melting points than leaded solders, aggravate the situation. Therefore, the knowledge of properties and performances is needed to be able to predict the lifetime of solders in order to assure successfully applications in electronic assemblies. This study focuses on the change of microstructure due aging in bulk and ball joints, and a preliminary analysis of the primary creep behavior of Sn-3.8Ag-0.7Cu. Differences in microstructure evolution between bulk and small joints are highlighted.

DTIC

Aging (Materials); Creep Properties; Cycles; Fatigue Life; Microstructure; Soldered Joints; Solders; Thermodynamics; Tin Alloys

20080005631 Michigan Univ., Ann Arbor, MI USA

Seed Effort Toward 'Multiscale Theoretical and Experimental Investigation of the Role of Structural Features on Damage Tolerance and Creep'

Ghosh, Amit; Lee, Rick; Nov 2007; 31 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0232

Report No.(s): AD-A474803; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474803>

This report summarizes research ideas and some results in relation to effort conducted toward understanding the role of grain boundaries and grain boundary defects on the mechanical properties of metals, and with evolving interest in testing and learning the behavior of small specimens. It has been shown that by considering grain boundaries having different properties from grains, strengthening of metals as affected by grain size can be predicted. The analysis reveals that deformation in

polycrystalline metals is heterogeneous and strain concentration evolves near grain boundary triple points and defects present on the grain boundary. An apparatus has been developed to perform tensile tests on small size samples within the chamber of the SEM. The tested samples of Ti-1100 alloy show considerably greater rate of strain hardening than specimens that are of conventional size. Because the grain size of these samples are the same, the higher hardening rate is believed to be a result of interaction of slip with specimen surface which occurs to a great extent per unit volume in the small size samples. Unfortunately, this seed effort remained as a seed effort and we were unable to continue the planned work due to inavailability of funds.

DTIC

Damage; Grain Boundaries; Microstructure; Seeds; Tolerances (Mechanics)

20080005673 National Cheng Kung Univ., Tainan, Taiwan, Province of China

Multi-channel ZnO Nanoconductors with Tunable Optoelectrical Properties

Liu, Chuan-Pu; Dec 6, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0078

Report No.(s): AD-A474831; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A new doping technology for controlled growth has been developed recently. Successful doping of ZnO nanomaterials is still a challenge even today due to the vapor pressure difference by orders of magnitudes between dopants and Zn and literature reports of successful doping are scarce. The alloying evaporation deposition (AED) method was used to synthesize Al doped ZnO nanowires with various doping concentrations. Several types of single-crystalline Zn and Zn/ZnO core-shell polyhedrons were synthesized step by step by CVD followed by designed oxidizing treatments. Direct evidences of apparent deformation of polyhedrons after stress relief were provided to prove the lattice mismatch effect. Room-temperature CL measurements show the polyhedrons exhibit tunable UV and green emissions with different oxidation conditions, which were attributed to surface and strain effects. The Zn/ZnO polyhedrons are promising for opto-electronic nanodevice applications.

DTIC

Cathodoluminescence; Nanostructures (Devices); Zinc Oxides

20080005678 Korean Atomic Energy Research Inst., Taejeon, Korea, Republic of

Consolidation of Al₂O₃ Nano-Ceramic Powders for High Power Micro-Wave Window

Kim, Whung W; Sep 19, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0037

Report No.(s): AD-A474849; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this study nanostructured α -Al₂O₃ ceramics have been fabricated by the combined application of magnetic pulsed compaction (MPC) and spark plasma sintering (SPS), and their density and hardness properties were investigated. The combined application of the MPC and the SPS produced very fine and dense alumina ceramics. The measured grain size was 330nm being slightly higher than the size of the starting powder (200-300nm), suggesting a very low degree of grain growth during the MPC and SPS processes and 99.7%, and the relative density was 99.7% being very close to the theoretical density (3.99g/cm³).

DTIC

Aluminum Oxides; Ceramics; Compacting; Consolidation; Powder (Particles); Powder Metallurgy; Sapphire

20080005698 Army Research Lab., Aberdeen Proving Ground, MD USA

An Analysis of Magnesium Alloy AZ31B-H24 for Ballistic Applications

Jones, Tyrone L; Burkins, Matthew S; Gooch, William A; Dec 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-IL162618AH80

Report No.(s): AD-A474892; ARL-TR-4327; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Army Research Laboratory is developing a ballistic specification for the use of magnesium alloy AZ31B-H24 as armor on Army platforms. Data were generated for a range of thicknesses of this magnesium alloy, 0.25 to 4 inches, with the use of five different projectiles. The magnesium performance is parametrically quantified on an equivalent areal density to meet the aluminum alloy 5083-H131, which means a mature, well defined, low-density metal. The results show that the performance of magnesium depends on the diameter of the threat. This research sets a baseline ballistic performance for magnesium alloy AZ31B-H24 for quality control purposes and for use in the development and evaluation of improved alloys.

DTIC

Aluminum Alloys; Armor; Ballistics; Magnesium Alloys

20080005849 Defence Science and Technology Organisation, Victoria, Australia

Electrical and Magnetic Properties of D6ac Steel

Burke, S K; Ibrahim, M E; Jul 2007; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474883; DSTO-TN-0757; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The room temperature electrical and magnetic properties of the high strength steel D6ac are documented in this report. These data were used to support a wider study on the application of magnetic rubber testing (MRT) for the structural integrity management of the RAAF F-111 aircraft. While the immediate purpose of this report is to provide documented supporting data for MRT applied to the F-111 application, the results will also benefit more general investigations on the use of magnetic and electromagnetic methods for non-destructive testing of high-strength steels.

DTIC

Electrical Properties; Magnetic Properties; Steels

20080006058 NASA Glenn Research Center, Cleveland, OH, USA

Materials Database Development for Ballistic Impact Modeling

Pereira, J. Michael; October 31, 2007; 32 pp.; In English; Fundamental Aeronautics Program Annual Meeting, 30-31 Oct. 2007, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.16.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006058>

A set of experimental data is being generated under the Fundamental Aeronautics Program Supersonics project to help create and validate accurate computational impact models of jet engine impact events. The data generated will include material property data generated at a range of different strain rates, from 1×10^4 (exp -4)/sec to 5×10^4 (exp 4)/sec, over a range of temperatures. In addition, carefully instrumented ballistic impact tests will be conducted on flat plates and curved structures to provide material and structural response information to help validate the computational models. The material property data and the ballistic impact data will be generated using materials from the same lot, as far as possible. It was found in preliminary testing that the surface finish of test specimens has an effect on measured high strain rate tension response of AL2024. Both the maximum stress and maximum elongation are greater on specimens with a smoother finish. This report gives an overview of the testing that is being conducted and presents results of preliminary testing of the surface finish study.

Author

Data Bases; Impact Tests; Jet Engines; Strain Rate; Flat Plates; Mechanical Properties

20080006087 Kangwon National Univ., Chuncheon, Korea, Republic of

High-Temperature Ferromagnetism in Cr- and Mn-Implanted Al(sub x)Ga(sub 1-x)N

Ryu, Mee-Yi; Sep 23, 2007; 22 pp.; In English

Contract(s)/Grant(s): FA5209-06-P-0213

Report No.(s): AD-A474971; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474971>

The purpose of this research is to investigate the magnetic properties of Cr- and Mn implanted Al_xGa_{1-x}N along with their electrical and optical properties. The objective of the research is to determine optimal conditions for fabricating thin films of Al_xGa_{1-x}N that display ferromagnetism. Although recent advances in ion-implantation doping of group-III nitrides with Cr and Mn are making progress, efficient and controlled doping of Al_xGa_{1-x}N with Cr and Mn by the ion implantation technique remains a challenging problem. Therefore, we have performed a systematic investigation of annealing temperature effects on magnetic, electrical, and optical properties of Cr-, Mn-, and Ni-implanted Al_xGa_{1-x}N to produce a good, thermally stable, single phase, room temperature, ferromagnetic AlGaCrN, AlGaMnN, and/or AlGaMnN.

DTIC

Ferromagnetism; High Temperature

20080006347 Texas Univ., Austin, TX USA

Results of Copper-Silver Rail Materials Tests

Castro, Zachira; Persad, Chadee; May 2006; 9 pp.; In English

Contract(s)/Grant(s): DAAD17-01-D-0001

Report No.(s): AD-A475281; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this phase of our investigation of better rail materials was to assess the multiple shot performances of copper-silver alloy (Cu-24% Ag) test coupons. The focus of these tests was on the assessment of changes in material properties

and microstructure of test coupons. The primary metric used was the change in hardness. Material surface deformations and microstructure changes were evaluated by optical microscopy and scanning electron microscopy. Hardness gradually increased as the number of tests increased. Test coupons in four states were studied: pretest; after one pulse test; after three pulse tests; and after eight pulse tests. The changes in hardness are related to the initial state of strain and dislocation distributions in the test specimens. The hardness is changed by the nucleation of new strain-free crystallites within the heavily worked, dislocation-dense grain structure. An annealing, recrystallization, and re-straining model is proposed to predict the bandwidth within which the hardness will fluctuate. The retained hardness of the copper-silver alloy test coupons has an average value that corresponds to a tensile strength greater than 650 MPa (100 ksi). This is well above the 500 MPa strength of the usual contacting aluminum alloy armature. Based on these test data, it is concluded that copper-silver remains an attractive material for use as a strong and thermally stable conductor.

DTIC

Copper; Copper Alloys; Rails; Silver; Silver Alloys

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*.

20080003011 Army Research Lab., Aberdeen Proving Ground, MD USA

Transparent Composite Utilizing Nonlinear Optical Polymers

O'Brien, Daniel J; Orlicki, Joshua A; Demaree, J D; Hirvonen, James K; Sep 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474075; ARL-TR-4287; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474075>

Polymer composites are attractive candidates for lightweight armor applications and can be made transparent by matching constituent refractive indices (RIs). Unfortunately, RI matching is difficult since the indices must be matched to approximately the third decimal place, and the matrix RI is very sensitive to factors such as temperature and stress state. Therefore, index matched systems are transparent only over a narrow temperature range. In order to capitalize on the superior properties of polymer composites in transparent armor applications, novel techniques are needed that can dynamically account for small changes in the RI. In this report, we investigate transparent composites that utilize polymer matrices whose RIs can be modulated in real time. Glass-reinforced composites are manufactured using polymers that incorporate nonlinear optical (NLO) chromophores small molecules whose RI can be changed with an applied electric field. We find that by utilizing typical NLO chromophores, the polymer matrix has insufficient electro-optical response for significant RI modulation.

DTIC

Composite Materials; Nonlinear Optics; Nonlinearity; Polymers; Transparency

20080003039 Florida Univ., Gainesville, FL USA

Polycarbosilane Elastomers via Chain-Internal and Chain-End Latent Crosslinking

Wagener, Kenneth; Zuluaga, Hector; Delgado, Paula; Aug 31, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0083

Report No.(s): AD-A474165; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474165>

The mission/objective of this work has been to identify a new class of hybrid polymers based on carbosilane/carbosiloxane chemistry, the objective being to create elastomers having excellent solvent resistance, high initial modulus, elasticity greater than 600%, and tensile strengths 2X greater than existing elastomers. Polymers have been synthesized and are being examined for their performance. All the required parameters for performance have been met excepting the tensile strength goal of 2X existing elastomers. While the project is now concluded from a funding perspective, we continue to examine the concept of dual latent crosslinking to achieve the tensile strength goal.

DTIC

Crosslinking; Elastomers; Polycarbosilanes; Silanes; Silicon; Siloxanes

20080003093 Explosives Research and Development Establishment, Waltham Abbey, UK
The Continuous Disintegration and Nitration of Cellulose Pulp Board: A Laboratory Study

Gerty, L H; Feb 8, 1958; 17 pp.; In English

Report No.(s): AD-A474214; ERDE-TM-3/M/58; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Cellulose; Cellulose Nitrate; Disintegration; Nitration

20080003141 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Cyclic Creep and Recovery Behavior of Nextel(Trademark) 720/Alumina Ceramic Matrix Composite at 1200deg C in Air and in Steam Environments

Whiting, Bridgett A; Sep 2007; 164 pp.; In English

Report No.(s): AD-A474333; AFIT/GAE/ENY/07-S05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The cyclic creep and recovery behaviors of the N720/Al₂O₃ composite were investigated in this research. The ceramic matrix composite (CMC) contains a porous alumina matrix with laminated, woven mullite/alumina (NextelTM 720) fibers. The composite does not have an interface between the fiber and matrix. The CMC relies on the porous nature for flaw tolerance. The objective of this study the influences of monotonic creep and cyclic creep loading histories on the creep lifetime, creep strain rate, accumulated creep strain as well as on the recovery of creep strain at near zero stress. The cyclic creep and recovery tests were performed at 1200 °C with maximum creep stress levels of 100 and 125 MPa in air and in steam. The creep and recovery periods were ranged from 3 min to 30 h. The laboratory air tests significantly exceeded the life of the monotonic creep tests. Introduction of intermittent periods of unloading and recovery at near zero stress into the monotonic creep history resulted in one to two orders of magnitude improvement in the creep life and rate. The presence of steam greatly reduced the performance of the material. The results in steam were similar to those of the monotonic creep. The composite microstructure, damage and failure mechanisms were also explored

DTIC

Aluminum Oxides; Ceramic Matrix Composites; Composite Materials; Creep Properties; Steam

20080005331 Library of Congress, Washington, DC USA
U.S. Trade Deficit and the Impact of Rising Oil Prices

Jackson, James K; Oct 17, 2007; 7 pp.; In English

Report No.(s): AD-A474605; CRS-RS22204; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Petroleum prices have risen sharply since early 2005. At the same time the average amount of imports of energy-related petroleum products has fallen slightly. The combination of sharply rising prices and a slightly lower level of imports of energy-related petroleum products translates into an escalating cost for those imports. This rising cost added an estimated \$70 billion to the nation's trade deficit in 2005 and \$50 billion in 2006. Imported energy prices moderated in early 2007, before rising again through the summer and fall, following a pattern of rising energy import prices in the spring and summer. This report provides an estimate of the initial impact of the rising oil prices on the nation's merchandise trade deficit. This report will be updated as warranted by events.

DTIC

Costs; Oils; Petroleum Products

20080005393 Mississippi Univ., University, MS USA
Dynamic Response and Simulations of Nanoparticle-Enhanced Composites

Mantena, P R; Al-Ostaz, Ahmed; Cheng, Alexander H; Nov 15, 2007; 246 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NOO014-O6-1-O577

Report No.(s): AD-A474745; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives of this research are to characterize the: (a) vibration and acoustic response; (b) low-velocity impact and high-strain energy absorption; (c) effects of freeze-thaw cycling; and (d) molecular dynamics simulations of nanoparticle-enhanced composites and fly-ash based foams that are being considered for the future generation naval structures or retrofitting of existing ones. In this study, the flexural/extensional dynamic modulus, damping, low-velocity impact and high-strain (Hopkinson bar) response of nylon 6,6 thermoplastic reinforced with multi-wall carbon nanotubes (MWCNT) were characterized. Preliminary investigations were also conducted on Derakane 411-350 vinyl ester thermoset, reinforced with Cloisite 30B nanoclay and exfoliated graphite nanoplatelets (xGnP). Molecular Dynamic (MD) simulations are used for

obtaining the elastic constants (C_{ij}) of SwCNT, MWCNT and nylon 6,6 nanocomposites.

DTIC

Dynamic Response; Fiber Composites; Graphitization; Nanoparticles; Simulation; Thermoplasticity

20080005607 Seoul National Univ., Korea, Republic of

Effect of Interface Structure on the Microstructural Evolution of Ceramics

Jo, Wook; Kim, Doh-Yeon; Hwang, Nong-Moon; Nov 6, 2007; 19 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0105

Report No.(s): AD-A474743; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474743>

The interface atomic structure was proposed to have a critical effect on the microstructure evolution during sintering of ceramic materials. In liquid-phase sintering, spherical grains show the normal grain growth behavior without exception, while angular grains often grow abnormally. The coarsening process of spherical grains with a disordered or rough interface atomic structure is diffusion-controlled, because there is little energy barrier for atomic attachments. On the other hand, kink-generating sources such as screw dislocations or two-dimensional (2-D) nuclei are required for angular grains having an ordered or singular interface structure. Coarsening of angular grains based on 2-D nucleation mechanism could explain the abnormal grain growth behavior. It was also proposed that densification process is closely related to the interface atomic structure. Enhanced densification by carefully chosen additives during solid state sintering was explained in terms of the grain boundary structural transition from an ordered to a disordered open structure.

DTIC

Ceramics; Microstructure; Sintering

20080005623 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA USA

Viscoelastic Characterization of Aliphatic Polyurethane Interlayers

MacAloney, Neil; Goulbourne, Nakhiah; Bujanda, Andres; Jensen, Robert; Oct 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-06-2-0014; Proj-AH42

Report No.(s): AD-A474775; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474775>

The viscoelastic properties of several commercially available aliphatic thermoplastic polyurethanes were characterized. Differential scanning calorimetry showed that for Deerfield 4700, Inter Materials IM 800, IM 800A, IM 1600, and IM 2500, there is a permanent physical change that occurs during heating. Dynamic mechanical analysis and shear rheometry were used to generate elastic and shear modulus master curves in the frequency domain for Inter Materials IM 800 A. The Williams-Landel-Ferry constants and Prony coefficients were extracted from these master curves. Quasi-static mechanical properties were determined from tensile tests on dog bone samples and compression tests on cylindrical samples. Visual image correlation was used to determine the Poisson's ratio from the mechanical tests by simultaneously capturing longitudinal and lateral strain.

DTIC

Aliphatic Compounds; Interlayers; Polyurethane Resins; Thermoplasticity; Viscoelasticity

20080005636 Clark-Atlanta Univ., GA USA

Novel Galvanic Corrosion Inhibitors: Synthesis, Characterization, Fabrication and Testing

Harruna, Issifu I; Sep 30, 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-1042

Report No.(s): AD-A474810; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474810>

In materials strategy, the Department of the Navy is the first to consider the development of novel anti-corrosion inhibitors. Thus we proposed to develop novel corrosion inhibitors based on polymer metallocomplex composite materials. These new materials can cut off the electron transfer path via the polymer metallocomplexes. Bipyridine-based polymerizable ligand monomers were synthesized starting from 4,5-diazatluoren-9-one (1). The copolymers of the polymerizable methacrylate-type monomer with styrene, methyl methacrylate, and butyl methacrylate have strong blue-light-emitting properties. Amphiphilic tris(2,2'-bipyridine)ruthenium-cored star polymers of polystyrene and poly(N-isopropylacrylamide) were found to self-assemble into core-shell micelles in which the ruthenium ions are located on the interface between core

and shell. The amphiphilic star-shaped metallopolymer with longer PNIPAM blocks formed micro-sized aggregates at high concentration. To prepare ligand-endfunctionalized polymers, we also synthesized ligand-functionalized initiators. We also synthesized the nanoparticles of zeolite Y (of various chemical compositions) using various techniques such as the addition of organic additives to conventional zeolite Y synthesis mixtures to suppress zeolite Y crystal growth; nanoporous silicate host materials of up to 30 nm pore diameter, using poly (alkylene oxide) copolymers, which when removed will yield a mesoporous material; and investigated the zeolite Y/Nannroas composite materials as hosts for corrosion inhibitors.

DTIC

Characterization; Copolymers; Corrosion Prevention; Electrochemical Corrosion; Fabrication; Ruthenium; Zeolites

20080005676 Indian Inst. of Tech., New Delhi, India

Functional Ceramic Ferroelectromagnetic Materials in Single Phase Solid-Solutions

Chatterjee, Ratnamala; Dec 5, 2007; 22 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0030

Report No.(s): AD-A474847; No Copyright; Avail.: Defense Technical Information Center (DTIC)

1. Perform a detailed study on magneto-dielectric effect in the ferroelectric ferromagnet (FEM) ternary oxide solid solutions like $\text{Bi(TM)O}_3\text{-(La}_{1-x}\text{RE}_x)_0.67(\text{Ba/Ca})_0.33\text{MnO}_3\text{-BTiO}_3$, where TM=transition metal, initially Fe, RE=Rare Earth and B= Ba, Pb. 2. To find suitable composition such that the ferroelectric and ferromagnetic properties are observable at or near room temperature. 3. To decrease the difference between the ferroelectric (T_{fe}) and ferromagnetic (T_N or T_c) transition temperatures by modifying BiFeO_3 , and 4. To enhance ferroelectromagnetic behavior in the modified BiFeO_3 . The details of the results and discussion are presented in the final report.

DTIC

Ceramics; Ferroelectricity; Ferromagnetism; Solid Solutions

20080005682 Pennsylvania State Univ., University Park, PA USA

Nanoporous Polymeric Grating-Based Optical Biosensors (Preprint)

Hsiao, Vincent K; Waldeisen, John R; Lloyd, Pamela F; Bunning, Timothy J; Huang, Tony J; Mar 2007; 21 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474860; AFRL-ML-WP-TP-2007-515; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper demonstrates a label-free biological sensing method using nanoporous polymer gratings. The high index modulation (0.07) of the nanoporous polymer grating structure generates a high signal-to-noise ratio, making the structure an ideal label-free biodetection platform. The fabrication process of the nanoporous polymeric grating involves holographic interference patterning and a functionalized pre-polymer syrup that facilitates the immobilization of biomolecules onto the polymeric sensor surface. The performance of the nanoporous polymeric sensor is evaluated by sequentially capturing biomolecules (biotin, streptavidin, biotinylated anti-rabbit IgG, and rabbit-IgG) onto the nanoporous regions and monitoring the changes in diffraction and transmission intensity. We have observed that diffraction intensity decreases and transmission intensity increases as biomolecules bind to the polymer structures, an observation consistent with our theoretical analysis. Furthermore, high molecular selectivity is demonstrated within this assay by immobilizing anti-rabbit IgG within the nanoporous polymer and observing the changes in the transmission and diffraction intensities upon the grating's exposure to rabbit and goat IgG (control). The two optical responses are profoundly different for each biomolecule and the selective binding of rabbit IgG is clearly evident. The nanoporous polymer grating-based biosensing method described in this paper is inexpensive, label-free, and amenable as a high-throughput assay, characteristics pertinent in many biomedical research and clinical applications.

DTIC

Bioinstrumentation; Biomedical Data; Medical Science; Optical Measuring Instruments; Optical Properties; Polymers; Signal to Noise Ratios

20080006061 Ohio Aerospace Inst., Cleveland, OH, USA

Ceramic Integration Technologies for Energy and Aerospace Applications

Singh, Mrityunjay; Asthana, Ralph N.; November 04, 2007; 20 pp.; In English; International Symposium on Advanced Ceramics and Technologies for Sustainable Energy Applications (ACTSEA-2007), 4-7 Nov. 2007, Pingfung, Taiwan, Province of China; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07ZA02A; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006061>

Robust and affordable integration technologies for advanced ceramics are required to improve the performance, reliability,

efficiency, and durability of components, devices, and systems based on them in a wide variety of energy, aerospace, and environmental applications. Many thermochemical and thermomechanical factors including joint design, analysis, and optimization must be considered in integration of similar and dissimilar material systems.

Author

Ceramics; Design Analysis; Durability; Aerospace Engineering; Reliability; Thermochemistry

20080006121 Air Force Research Lab., Wright-Patterson AFB, OH USA

On the Structure of Holographic Polymer Dispersed Polyethylene Glycol (Preprint)

Bunning, Timothy J; Birnkrant, Michael J; McWilliams, Hillary; Li, Christopher Y; Natarajan, Lalgudi V; Tondiglia, Vincent P; Sutherland, Richard L; Lloyd, Pamela F; Oct 2006; 27 pp.; In English

Contract(s)/Grant(s): Proj-4347

Report No.(s): AD-A475024; AFRL-ML-WP-TP-2007-526; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475024>

Holographic polymerization (H-P) has been used to fabricate polymer dispersed liquid crystals and pattern inert nanoparticles. In this article, one-dimensional grating structures of Norland resin and polyethylene glycol (PEG) was achieved using the H-P technique. Both reflection and transmission grating structures were fabricated. The optical properties of the reflection grating structures (also known as Bragg reflectors (BRs)) are thermosensitive, which can be attributed to the formation and crystallization of PEG crystals. The thermal switching temperature of the BR can be tuned by using different molecular weight PEG samples. The hierarchical structure and morphology of the BR were studied using synchrotron X-ray, polarized light microscopy, and transmission electron microscopy. PEG crystals were found to be confined in ~60 nm thick layers in the BR. Upon crystallization, the PEG lamellae were parallel to the BR surfaces and PEG chains were parallel to the BR normal, resembling the confined crystallization behavior of polyethylene oxide (PEO) in PEO-block-polystyrene (PEO-b-PS) block copolymers. This observation suggests that the tethering effect in the block copolymer systems does not play a major role in PEG chain orientation in the confined nanoenvironment.

DTIC

Block Copolymers; Glycols; Holography; Polyethylenes; Polymerization

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*.

20080002942 Naval Health Research Center, Wright-Patterson AFB, OH USA

Development of an Infrared Spectrophotometric Method for the Analysis of Jet Fuel Using a Loop Calibration Technique

Reboulet, James; Cunningham, Robert; Gunasekar, Palur G; Chapman, Gail D; Stevens, Sean C; Mar 2007; 18 pp.; In English Report No.(s): AD-A473934; NHRC/EHEL-07-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473934>

A whole body inhalation study of combined jet fuel vapor and aerosol necessitated the development of a method for preparing vapor standards from the neat fuel. Due to the complex mixture of components in jet fuel, and the selective partitioning between aerosol and vapor, a novel method was needed to prepare vapor only standards for the calibration of infrared spectrophotometers and a gas chromatograph. A re-circulating loop system was developed which provided vapor only standards whose composition matched those seen in an exposure system. Comparison of nominal concentrations in the exposure system to those determined by infrared spectrophotometry and gas chromatography were in 80%-99% agreement.

DTIC

Calibrating; Gas Chromatography; Infrared Radiation; Jet Engine Fuels; Respiration; Spectrophotometry

20080003096 Explosives Research and Development Establishment, Waltham Abbey, UK
Consideration of the Mechanical Properties of Rocket Propellants in Relation to Their Use in Large Rocket Motors. Part 2. Plastic and Highly Elastic Propellants

Lawson, C G; Jan 1951; 23 pp.; In English

Report No.(s): AD-A474224; ERDE-3/TN/51; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Mechanical Properties; Plastic Propellants; Propellants; Rocket Engines; Rocket Propellants

20080003098 Explosives Research and Development Establishment, Waltham Abbey, UK
Consideration of the Mechanical Properties of Rocket Propellants in Relation to Their Use in Large Rocket Motors. Part 1. Colloidal Propellants

Lawson, C G; Jan 1951; 13 pp.; In English

Report No.(s): AD-A474226; ERDE-1/TN/51; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Colloidal Propellants; Mechanical Properties; Propellants; Rocket Engines; Rocket Propellants

20080003115 Explosives Research and Development Establishment, Waltham Abbey, UK
Rates of Burning and Flame Temperatures of Some Diluted Nitric Ester Monopropellant Systems

Powling, J; Smith, W A; Oct 1959; 36 pp.; In English

Report No.(s): AD-A474272; ERDE-TM-11/M/59; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Combustion; Dilution; Esters; Flame Temperature; Monopropellants

20080003189 Universal Technology Corp., Dayton, OH USA
Propulsion and Power Rapid Response Research and Development Support. Delivery Order 0042: Demonstration and Evaluation of Fischer-Tropsch Research Fuels for the DoD Assured Fuels Program

Klein, James K; Puterbaugh, Michele; Morris, Jr, Robert; Dec 2006; 131 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F33615-02-D-2299-0042; Proj-4412

Report No.(s): AD-A474420; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this project was to produce, analyze and deliver Fischer-Tropsch research fuel to a draft specification in the quantities required for direct support of high priority DoD-assured fuels research, demonstration plans, and schedules. A Fischer-Tropsch research fuel was successfully produced by the Syntroleum Corporation to a draft specification and 104,278 gallons was delivered to the DoD Assured Fuels Research Program. Trend analyses shows that a very consistent product was produced and shipped.

DTIC

Chemical Reactions; Fischer-Tropsch Process; Fuels; Propulsion; Propulsion System Configurations; Propulsion System Performance

20080003363 Explosives Research and Development Establishment, Waltham Abbey, UK
Cast Double Base Propellants: Process Mechanics

Hamann, J B; Feb 1953; 51 pp.; In English

Report No.(s): AD-A474219; ERDE-29/R/52; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Double Base Propellants; Propellant Casting

20080005259 Pennsylvania State Univ., University Park, PA USA
Advanced Thermally Stable Coal-Based Jet Fuels

Schobert, Harold H; Oct 2007; 40 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0290; Proj-2308

Report No.(s): AD-A474564; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474564>

This report summarizes briefly the key results of a project for the development of coal-based jet fuel. The initial focus of the project was the development of a high heat sink fuel, JP-900, that could be used for thermal management as well as

for propulsion energy. In the last year the focus shifted to development of a coal-based drop-in replacement for JP-8. Prototype fuel from hydrogenation of a mixture of light cycle oil and refined chemical oil met or exceeded all but four W-8 specifications. The fuel has excellent low-temperature viscosity behavior and O-ring seal swell comparable to JP-8. Deposition from thermal stressing of the fuel in various reactors was invariably lower than JP-8 or JP-8+IOO. Mechanisms of oxidative deposit formation for both jet and diesel fuels are proposed to account for the fact that the chemistry involved in both storage and thermal oxidative deposit formation in middle distillates is similar. The fuel was successfully tested in a T63 turboshaft engine, with emissions only slightly greater than JP-8. Well over a hundred publications resulted from the seven-year project period.

DTIC

Coal; Jet Engine Fuels; Thermal Stability

20080005668 Naval Research Lab., Washington, DC USA

Potential for Peroxide and Gum Formation in Ultra-Low-Sulfur Diesel Fuels

Willauer, Heather D; Hardy, Dennis R; Morris, Robert E; Williams, Frederick W; Oct 31, 2007; 24 pp.; In English

Report No.(s): AD-A474818; NRL/MR/6180--07-9087; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes an open literature survey that was conducted to determine the level of risk associated with using Ultra Low Sulfur Diesel (ULSD) Fuels in Naval operations. The findings show the level of risk for hydroperoxide and soluble gum formation in these fuels is not well understood. Thus, specific test methods have been identified for determining if these fuels will meet the Navy's long-term storage requirements. In addition, approved antioxidants formulations for jet fuel (MIL-DTL-5624R) have been recommended as a potential solution in mitigating peroxide and gum formation in ULSD.

DTIC

Diesel Fuels; Gums (Substances); Jet Engine Fuels; Peroxides; Sulfur

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SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20080005520 NASA Glenn Research Center, Cleveland, OH, USA

MISSE 2 PEACE Polymers Atomic Oxygen Erosion Experiment on the International Space Station

deGroh, Kim K.; Banks, Bruce A.; McCarthy, Catherine E.; Rucker, Rochelle N.; Roberts, Lily M.; Berger, Lauren A.; [2008]; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 698671.01.03.51; Copyright; Avail.: Other Sources

Forty-one different polymer samples, collectively called the Polymer Erosion and Contamination Experiment (PEACE) Polymers, have been exposed to the low Earth orbit (LEO) environment on the exterior of the International Space Station (ISS) for nearly four years as part of Materials International Space Station Experiment 2 (MISSE 2). The objective of the PEACE Polymers experiment was to determine the atomic oxygen erosion yield of a wide variety of polymeric materials after long term exposure to the space environment. The polymers range from those commonly used for spacecraft applications, such as Teflon FEP, to more recently developed polymers, such as high temperature polyimide PMR (polymerization of monomer reactants). Additional polymers were included to explore erosion yield dependence upon chemical composition. The MISSE PEACE Polymers experiment was flown in MISSE Passive Experiment Carrier 2 (PEC 2), tray 1, on the exterior of the ISS Quest Airlock and was exposed to atomic oxygen along with solar and charged particle radiation. MISSE 2 was successfully retrieved during a space walk on July 30, 2005 during Discovery's STS-114 Return to Flight mission. Details on the specific polymers flown, flight sample fabrication, pre-flight and postflight characterization techniques, and atomic oxygen fluence calculations are discussed along with a summary of the atomic oxygen erosion yield results. The MISSE 2 PEACE Polymers experiment is unique because it has the widest variety of polymers flown in LEO for a long duration and provides extremely valuable erosion yield data for spacecraft design purposes.

Author

Aerospace Environments; Charged Particles; Earth Orbital Environments; Oxygen Atoms; Polymers; Spacecraft Construction Materials

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*.

20080003045 Naval Observatory, Washington, DC USA

Analysis of Clock Modeling Techniques for USNO Cesium Mean

Skinner, J; Koppang, P; Jan 1, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474175; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474175>

The U.S. Naval Observatory (USNO) maintains an ensemble of commercial cesium frequency standards. The mean time scale generated from this ensemble is used as the long term frequency reference for all USNO clocks. Maintenance of this mean is currently done in a post-processing fashion with clock models being adjusted as far as 75 days into the past. While this method ensures the resulting mean is stable in the past, it can create errors in the near-real-time determination of the frequency of the mean. This in turn adds to the uncertainty in the determination of the clock frequencies relative to the mean. Multiple methods for adjusting clock models in near real time are examined and tested on actual clock data.

DTIC

Algorithms; Cesium; Clocks; Observatories

20080003082 Naval Observatory, Washington, DC USA

Time and Frequency Activities at the U.S. Naval Observatory

Matsakis, Demetrios; Jan 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474178; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. Naval Observatory (USNO) has provided timing for the Navy and the Department of Defense since 1830 and, in cooperation with other institutions, has also provided timing for the USA and the international community. Its Master Clock (MC) is the source of UTC (USNO), the USNO's realization of Coordinated Universal Time (UTC), which has stayed within 5 ns RMS of UTC since 1999. The data used to generate UTC (USNO) are based upon 73 cesium and 21 hydrogen maser frequency standards in three buildings at two sites. The USNO disseminates time via voice, telephone modem, LORAN, Network Time Protocol (NTP), GPS, and Two-Way Satellite Time Transfer (TWSTT). The USNO would not be able to meet all the requirements of its users had it kept to the same technology it had 10 years ago; 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 on-line or by contacting the author directly.

DTIC

Clocks; Frequencies; Frequency Standards; Navy; Observatories

20080003091 National Inst. of Standards and Technology, Boulder, CO USA

Effects of the Rooftop Environment on GPS Time Transfer

Lombardi, Michael A; Novick, Andrew N; Jan 1, 2007; 19 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474207; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We examine the effects of the rooftop environment on GPS time transfer, in particular the effects of multipath reflections from nearby metallic objects. Three different antenna sites on the roof of the NIST laboratories at Boulder, Colorado, were selected, each with different multipath characteristics that we discuss. Simultaneous tests were conducted at each site with the same model of L1 band GPS receiver, but with different types of antennas. Four different types of active antennas with low-noise amplifiers were used at each site: a patch antenna, a patch antenna with a simple choke ring attached, a quadrifilar helix, and a 'pinwheel' antenna with an aperture coupled slot array design. Results are presented that demonstrate how each antenna performs in each multipath environment, with the time deviation ($\sigma_{x(\tau)}$) used as a metric. We also discuss the potentially harmful effects on time transfer caused by RF interference from other active GPS antennas located on the same roof.

DTIC

Antennas; Environmental Tests; Global Positioning System; Roofs

20080003092 National Inst. of Standards and Technology, Boulder, CO USA

GPS Signal Integrity Dependencies on Atomic Clocks

Weiss, Marc; Shome, Pradipta; Beard, Ron; Jan 1, 2007; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474208; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The problem of signal integrity for GPS satellites and the primary dependency upon inherent characteristics of onboard atomic frequency standards are discussed. In particular, there is a need for characterizing peak deviation of GPS clocks from prediction. Results from a preliminary study of two GPS clocks tested on the ground show that the distribution of peak deviations from prediction cannot be assumed to be Gaussian.

DTIC

Atomic Clocks; Global Positioning System

20080003126 Fighting Vehicles Research and Development Establishment, Chertsey, UK

Trials Against Conqueror Tanks with Additional Ballistic Protection. Part 2: The Use of Large Hollow-Charge Warheads

May 1957; 44 pp.; In English

Report No.(s): AD-A474293; FVRDE-TR-2/2; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The results of static trials of American 'Dart' (T.42) hollow-charge warheads fired against a fully stowed up-armored Conqueror with spaced armor protection indicated that, in these conditions: (i) the penetrative performance of 'Dart' was extremely marginal, and (ii) when the armor was penetrated the 'Dart' kill capabilities were associated with ammunition fires and crew lethality rather than with mechanical damage. A single experimental 'Malkara' hollow-charge warhead was also fired; this produced an effective kill. The results suggest that a 'Dart' type of warhead with the substitution of a copper cone might form a very effective G.W. warhead with a total weight not exceeding 25 pounds.

DTIC

Armor; Protection; Static Tests; Warheads

20080003136 Old Dominion Univ., Norfolk, VA USA

Experimental Evaluation of Performance Feedback Using the Dismounted Infantry Virtual After Action Review System. Long Range Navy and Marine Corps Science and Technology Program

Bliss, James P; Bustamante, Ernesto A; Fallon, Coret K; Ely, Katherine M; Nov 14, 2007; 24 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0171

Report No.(s): AD-A474315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Training soldiers for modern warfare is a critical and complex undertaking. An important tool used to train soldiers is the after action review (AAR), during which soldier trainees review positive and negative aspects of past training performances. The Dismounted Infantry Virtual After Action Review System (DIVAARS), created by the Army Research Institute and the Institute for Simulation and Training, allows soldiers to review past immersive training exercises. Our experimental team planned to use DIVAARS to study variables that may influence the effectiveness of performance feedback in an AAR. Planned experiments were to isolate and evaluate the roles of feedback timing, content, and teamed review on AAR quality and comprehensiveness and reviewers' situation awareness and perceived workload. Unfortunately, due to complications surrounding the acquisition of active duty military participants, we were unable to complete our proposed experiments. The following report describes the results of our literature review and the tasks we were able to complete in support of ARI/PEOSTR.

DTIC

Education; Feedback; Navy; Research and Development; Simulation; Technologies; Virtual Reality

20080003326 Army Natick Soldier Center, Natick, MA USA

Evaluation of the Long Range Patrol Packet

Johnson, Wendy K; Kramer, F M; Nov 2007; 129 pp.; In English

Report No.(s): AD-A473908; NATICK/TR-08/002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473908>

An evaluation of new items for future versions of the Long Range Patrol Packet (LRP) and Meal, Cold Weather (MCW) was conducted at Grafenwoehr, Germany. The current LRP was evaluated for comparative purposes. The evaluation consisted

of issuing the LRP to soldiers during 4 days of regular field training. Surveys concerning intake and acceptability were collected daily.

DTIC

Dehydrated Food; Field Tests; Patrols; Rations

20080003338 National Geospatial-Intelligence Agency, Saint Louis, MO USA

AF/NGA GPS Monitor Station High-Performance Cesium Frequency Standard Stability 2005/2006: From NGA Kalman Filter Clock Estimates

Manning, Dennis M; Jan 2007; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474262; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Both the National Geospatial-Intelligence Agency (NGA) and the USA Air Force (USAF/AF) operate a worldwide network of GPS monitoring stations that utilizes high-performance cesium frequency standards (CFSs) and geodetic quality GPS receivers. The USAF stations are somewhat equatorial, whereas the NGA stations are primarily in both the Northern and Southern Hemispheres. The NGA Monitor Station Network (MSN) has been in operation since 1983 and the operation in St. Louis currently monitors all the NGA stations on a 24/7 basis. The USAF operates their stations in a similar manner. The NGA monitor station CFSs are located in non-laboratory environments and in some instances, are logistically challenging. With the onset of the Department of Defense GPS Accuracy Improvement Initiative (AII), the NGA monitor station cesiums, along with the associative electronics, must be monitored more frequently for quality control. AII involves the USAF Operational Control Segment (OCS), at Schriever AFB, to incorporate at first a subset (six) of the NGA monitor stations in real-time processing to improve the quality of the broadcast ephemeris and clock parameters. Two more NGA monitor stations were added in the early fall 2006. The remaining three are scheduled to be added during the fall/winter 2006 time frame. The addition of the NGA stations will expand the network coverage to allow all GPS satellites to be monitored without any gaps.

DTIC

Cesium; Clocks; Estimates; Frequency Standards; Global Positioning System; Kalman Filters; Stability

20080003339 National Inst. of Standards and Technology, Boulder, CO USA

Long-Term Stability of NIST Chip-Scale Atomic Clock Physics Packages

Knappe, S; Shah, V; Gerginov, V; Brannon, A; Hollberg, L; Kitching, J; Jan 1, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474197; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present measurements regarding the long-term frequency stability of NIST chip-scale atomic clock (CSAC) physics packages. Changes of the clock frequency are caused mainly through time-dependent light shifts by the frequency-modulated VCSEL and properties of the vapor cell. We suggest advanced CPT interrogation schemes to relax the requirements on the temperature stability of the VCSEL as well as the power of the local oscillator. Finally, we discuss the advantages and limitations of these techniques when implemented into a small package.

DTIC

Atomic Clocks; Chips; Frequencies; Frequency Stability; Laser Cavities; Stability; Surface Emitting Lasers

20080003352 Air Force Research Lab., Wright-Patterson AFB, OH USA

Biomimetics and the Application to Devices (Preprint)

Stone, Morley O; Sep 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473978; AFRL-ML-WP-TP-2007-531; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473978>

At first glance, imitating nature via biomimetics seems to be a straightforward proposition. For example, if one is a roboticist, just add legs to the platform instead of wheels. Unfortunately, and as often the case, the devil is in the details. This short synopsis will cover biomimetic examples of material synthesis, sensing and robotics. This overview will attempt to capture some lessons learned, some surprising and unanticipated insights, and some of the potential pitfalls encountered along the way. For a more complete review, recent perspectives on combining biology with other disciplines have recently been published.

DTIC

Biomimetics; Mechanical Devices; Robotics; Macromolecules

20080005218 Army Research Lab., Aberdeen Proving Ground, MD USA

On the Viability of Magnetometer-Based Projectile Orientation Measurements

Harkins, Thomas E; Nov 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A474475; ARL-TR-4310; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Vector magnetometers are being widely considered for roll orientation estimation in a number of guided projectile programs. The U.S. Army Research Laboratory (ARL) has included vector magnetometers in inertial sensor suites in several hundred projectile test and evaluation flight experiments since the mid 1990s. Based on analyses and experiences with these devices, circumstances affecting magnetometer-based measurements have been identified and investigated. Results of these analytic and experimental efforts will be presented to support the conclusion that magnetometers are viable roll orientation sensors when properly employed.

DTIC

Magnetometers; Projectiles; Viability

20080005324 Library of Congress, Washington, DC USA

The National Bio- and Agro-Defense Facility: Issues for Congress

Shea, Dana A; Monke, Jim; Gottron, Frank; Oct 4, 2007; 19 pp.; In English

Report No.(s): AD-A474597; CRS-RL34160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The agricultural and food infrastructure of the USA is potentially susceptible to terrorist attack using biological pathogens. In addition to the impacts of such an attack on the economy, some animal diseases could potentially be transmitted to humans. These diseases are known as zoonotic diseases. Scientific and medical research on plant and animal diseases may lead to the discovery and development of new diagnostics and countermeasures, reducing the risk and impact of a successful terrorist attack. To safeguard the USA against animal disease, the U.S. Department of Agriculture (USDA) engages in research on animal diseases not native to the USA at the Plum Island Animal Disease Center (PIADC) off the coast of New York. With the formation of the Department of Homeland Security (DHS) in 2003, the PIADC facility was transferred from USDA to DHS, though USDA continues its research program at the facility. DHS has established a foreign animal disease research program in cooperation with USDA at PIADC. DHS has identified the facility as outdated and too limited to continue to be the primary research facility. Homeland Security Presidential Directive 9 tasks the Secretaries of Agriculture and Homeland Security to develop a plan to provide safe, secure, and state-of-the-art agriculture biocontainment laboratories for research and development of diagnostic capabilities and medical countermeasures for foreign animal and zoonotic diseases. To partially meet these obligations, DHS has announced plans to construct a new facility, the National Bio- and Agro-Defense Facility (NBAF). This facility would house high-containment laboratories able to handle the pathogens currently under investigation at PIADC, as well as other pathogens of interest. The DHS plans to select the site in 2008 and open NBAF in 2014. The final construction costs will depend on the site location and may exceed the \$451 million projected cost.

DTIC

Agriculture; Diseases; Microorganisms; Pathogens; Research Facilities; Veterinary Medicine

20080005382 Washington Univ., Seattle, WA USA

Measurements of Gulf Stream Transport with a Towed Transport Meter (TTM2) on R/V Oceanus Cruise 216

Dunlap, John H; Drever, Robert G; Kennelly, Maureen A; Sanford, Thomas B; Apr 1992; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): OCE-90-O0050

Report No.(s): AD-A474720; APL-UW-TR-9209; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Measurements of oceanic velocities were made with towed transport meter (TTM2) during R/V Oceanus cruise 216 from 30 November to 13 December 1989 to observe surface and subsurface flows under GEOSAT tracks between the continental USA and Bermuda. TTM2, a single-axis version of the TTM electromagnetic sensor package, determines the motionally induced electric field parallel to the ship's heading. The electric field is denoted as F_{ν}^{ν} where F_{ν}^{ν} is the vertical component of the earth's magnetic field, ν is the surface velocity component of the ocean normal to the ship's heading, and ν is the conductivity-weighted, vertically averaged velocity component normal to the ship's heading. The electric field measurement is combined with vessel motion determined from LORAN-C to obtain ν . Corrections were made for electrical conductivity factors and vessel windage effects to yield continuous determination of the component ν normal to the vessel's track. The estimates of ν were multiplied by water depth and integrated along the track to determine the volume transport distribution between the U.S. and Bermuda. The TTM2 instrument system, its usage on Oceanus cruise

216, and preliminary results are discussed. A transport of 60 Sv was observed across the Gulf Stream offshore of Cape Hatteras to Bermuda in a large cold-core eddy.

DTIC

Electromagnetic Fields; Gulf Stream; Oceanographic Parameters; Oceanography

20080005671 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Characterization of Chemical Weapons Convention Schedule 3 Compounds by Quantitative ¹³C NMR Spectroscopy

Henderson, Terry J; Cullinan, David B; Nov 2007; 26 pp.; In English

Contract(s)/Grant(s): Proj-05P-0199

Report No.(s): AD-A474829; ECBC-TR-591; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A quantitative ¹³C NMR method has been developed for characterizing hydrogen cyanide, cyanogen chloride, and phosgene, three Chemical Weapons Convention Schedule 3 compounds in common use today. Towards this end, the ¹³C spin-lattice relaxation behavior (T₁) of the compounds has been assessed at 75 and 126 MHz for temperatures between 5-15 deg C, holding them in their liquid states to dramatically improve detection sensitivity. The derived single exponential T₁ values were used to derive relaxation delays for collecting quantitative ¹³C data sets yielding a signal-to-noise ratio (S/N) exceeding that necessary for certifying the compounds at greater or equal 95 carbon atom % and 99% confidence. At 126 MHz, only a single data acquisition with a high-sensitivity cryogenic probe head exceeded the certifying S/N; however, for analysis at 75 MHz with a conventional probe head, greater or equal 5 acquisitions were necessary for phosgene, and greater or equal 12 acquisitions were necessary for the other two compounds. In terms of accuracy and execution time, the resulting NMR method rivals typical chromatographic methods.

DTIC

Chemical Warfare; Conventions; Nuclear Magnetic Resonance; Purity; Schedules; Spectroscopy

20080006079 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Evaluation of Unexploded Ordnance (UXO) Detection Technology at the Standardized UXO Test Sites Aberdeen and Yuma Proving Grounds

Banta, Matthew; Boughers, Ward; McClung, Christina; Fling, Rick; Burch, William; Karwatka, Michael; Nov 2007; 314 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8-CO-160-UXO-021

Report No.(s): AD-A474960; ATC-9379; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474960>

The U.S. Army Environmental Command (USAEC) issued a Test Execution Directive to Aberdeen Test Center (ATC), Aberdeen Proving Ground (APG), Maryland, to plan, perform, and report the evaluation of unexploded ordnance (UXO) detection technology. The standardized UXO test sites at APG and Yuma Proving Ground (YPG) were used to (1) determine detection and discrimination effectiveness under realistic scenarios that varied targets, geology, clutter, topography, and vegetation; (2) determine cost, time, and manpower requirements to operate the technology; (3) determine the demonstrator's ability to analyze survey data in a timely manner and provide prioritized target lists with associated confidence levels; and (4) provide independent site management to enable the collection of high quality, Ground Truth (GT), geo-referenced data for postdemonstration analysis. Testing emphasized the demonstration and evaluation of government and private industry ordnance detection systems.

DTIC

Explosives Detection; Ordnance; Project Management; Standardization; Tests

20080006109 Naval Research Lab., Washington, DC USA

Adaptive Optics Performance Model for Optical Interferometry

Mozurkewich, D; Restaino, S R; Armstrong, J T; Gilbreath, G C; Jul 10, 2007; 11 pp.; In English

Report No.(s): AD-A475009; NRL-06-1226-3323; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475009>

The optical interferometry community has discussed the possibility of using adaptive optics (AO) on apertures much larger than the atmospheric coherence length in order to increase the sensitivity of an interferometer, although few quantitative models have been investigated. The aim of this paper is to develop an analytic model of an AO-equipped interferometer and to use it to quantify, in relative terms, the gains that may be achieved over an interferometer equipped only with tip tilt correction. Functional forms are derived for wavefront errors as a function of spatial and temporal coherence scales and flux

and applied to the AO and tip tilt cases. In both cases, the AO and fringe detection systems operate in the same spectral region, with the sharing ratio and subaperture size as adjustable parameters, and with the interferometer beams assumed to be spatially filtered after wavefront correction. It is concluded that the use of AO improves the performance of the interferometer in three ways. First, at the optimal aperture size for a tip tilt system, the AO system is as much as 50% more sensitive. Second, the sensitivity of the AO system continues to improve with increasing aperture size. And third, the signal-to-noise ratio of low-visibility fringes in the bright-star limit is significantly improved over the tip tilt case.

DTIC

Adaptive Optics; Interferometry; Performance Prediction

20080006145 Army Research Lab., Aberdeen Proving Ground, MD USA

Instrumentation for Aim Point Determination in the Close-in Battle

Haas, Gary A; Dec 2007; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622618H0300

Report No.(s): AD-A475101; ARL-TN-0303; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475101>

A rifle-mounted, boresighted camera and rugged video recorder can be used to determine where the rifle is pointed at the time the trigger is pulled. This information can be collected in exercises simulating close combat to help us better understand how to optimize small arms for this battle space. In this report, we examine issues in instrumenting the Soldier and suggest an approach to collecting this sort of data.

DTIC

Boresights; Distance; Instruments; Rifles

20080006323 Princeton Univ., NJ USA

Physics of Spin-Polarized Media

Happer, William; Jau, Yuan-Yu; Nov 21, 2007; 10 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0199; Proj-2301/DX

Report No.(s): AD-A475220; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The work supported by this AFOSR grant focused on fundamental physics and the applications of spin-polarized species. Some of the most notable accomplishments were as follows: (1) using optically pumped alkali-metal vapor to polarize the nuclei of solid materials; (2) making much simpler atomic clocks with the physics of push-pull optical pumping, an efficient new pumping method that the authors discovered during the course of the grant; (3) nonlinear 'pressure shifts' of atomic clock frequencies due to the formation of van der Waals molecules; (4) the discovery and interpretation of unexpected signal reversals of magnetic resonance lines used in atomic clocks; (5) a new method of filling atomic clock and magnetometer cells by electrolysis through the glass walls; (6) new investigations of optical pumping and magnetic resonances of spin-polarized metastable xenon atoms; and (7) the discovery of universal contaminants of the alkali metal used in atomic clocks and magnetometers. Most of the work supported by this AFOSR grant has had and will continue to have applications to technologies of importance to the Department of Defense and to the U.S. Air Force. For example, atomic clocks based on push-pull pumping have substantially fewer parts and higher signal-to-noise ratios than conventional atomic clocks. They can be more stable, smaller, less expensive and consume less electrical power than conventional atomic clocks, and they could be used to improve the performance and decrease the cost of geolocation systems. Sections are as follows: Spin-transfer optical pumping of solids, Photonic clocks, Hyperfine frequency shifts due to van der Waals molecules, Signal reversal of magnetic resonances, Electrolytic cell filling technique, Magnetic resonance for spin-polarized metastable xenon atoms, and Contaminants of alkali metals.

DTIC

Alkali Metals; Atomic Clocks; Electrolytic Cells; Magnetic Resonance; Miniaturization; Nuclear Spin; Optical Pumping

20080006346

Mixed-Flow Waterjet (MxWJ) Model 5662-1: Initial Study of Yaw Effects on Waterjet Powering and Transom Depth Effects on Waterjet Priming

Cusanelli, Dominic S; Dec 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475278; NSWCCD-50-TR-2007/O93; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is a partial documentation a series of model-scale experiments conducted 5/07-6/07, on Mixed-Flow Waterjet

(MxwJ) Model 5662-1, a waterjet propelled variant of the Joint High Speed Sealift (JHSS) hull platform. This document contains data and evaluations from initial investigations into the following two waterjet topic areas: (1) The effects of model yaw angles on waterjet powering. Model-scale rotor force measurements of thrust and torque at angles of yaw up to 3 degrees showed little variation compared to the equivalent forces measured at zero yaw angle. Model drag and side forces, as expected, showed substantial increases as yaw angle was increased. (2) The effects of variations in model transom depth, and by extension the submergence of the waterjet pump inlet, on the priming of the waterjets. Visual observations as to the state of fluid flow through the waterjets indicated that the initial waterjet design criterion of retaining 50% of the rotor submerged was conservative, and could be relaxed somewhat for future designs.

DTIC

Depth; Hydraulic Jets; Jet Propulsion; Marine Propulsion; Multiphase Flow; Yaw

32

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*.

20080002932 Naval Postgraduate School, Monterey, CA USA

Mesh Networks within A Distributed Operations Framework Utilizing IP Based Radios

Simmons, Randall J; Curran, Christopher C; Sep 2007; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473913; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473913>

Currently the USMC employs numerous radio sets to establish a tactical network in order to communicate in the Area of Operations. These radio sets include AN/PRC-150(C) HF, SINCGARS VHF, & AN/ARC-210 UHF radios. In every instance, these sets require individualized training and calibration to ensure that they all operate when needed. Further, these independent systems often have difficulty cross-communicating, as a result of incorrect time hacks, outdated fills, or improper frequency ID's, the list goes on. The way the Marine Corps has dealt with this is to establish a Tactical Network such as the Fire Support Coordination Center (FSCC) and Direct Air Support Center (DASC) that act as liaison between these elements. This slows down the passing of information and even loses words, phrases, and (often times) the meaning of what is being communicated. Emerging on the scene is the Global Information Grid (GIG) that brings with it a veritable cornucopia of information and a network of resources that would be unreachable by UHF/VHF/HF communications. To access this, the Department of Defense in general, and the Marine Corps in specific needs to adopt communications devices that speak the same language; IP-based radios are the only viable option.

DTIC

Communication Networks; Protocol (Computers); Radio Equipment

20080002985 Naval Postgraduate School, Monterey, CA USA

The Preparedness Web: Utilizing Regional Collaborative Networks for Homeland Security Preparedness

Holbrook, Christopher C; Sep 2007; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474027; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474027>

This case study is offered with the purpose of informing the initiation of regional collaborative efforts nationwide. This research effort examines a network of networks, called here a Preparedness Web, utilized to meet locally identified regional homeland security preparedness needs. How and why these networks were established is documented to allow other regions to draw parallels to their own situations. A measurement of the systems collaborative capacity is identified to validate the systems functionality. Recommendations are offered for other regions considering collaborative efforts based upon a retrospective examination of the system originators strategic intent. To the extent to which this effort can be used to illustrate successful collaboration, on a national basis, it presents a replicable ground up process designed to entice more agencies to undertake or enhance their own regional collaborative preparedness efforts.

DTIC

Communication Networks; Security

20080002994 Naval Postgraduate School, Monterey, CA USA

Impacts and Consequences of Non-Standard COTS C4I System Acquisition Upon Associated Programs of Record

Huskey, Ted W; Sep 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474044>

In response to the Global War on Terror's data communication demands, Navy commands acquired COTS C4I Tactical Data Link equipment outside standard acquisition practices. This thesis analyzes the circumstance of the non-standard acquisition and fielding of COTS Data Link equipment impact upon similar capability Programs of Record using a case study of the Navy's acquisition of the Air Defense System Integrator (ADSI). Additionally, this thesis analyzes practices and philosophies that could be implemented to prevent future occurrences. Despite years of reform, DoD acquisition system does not field capabilities quickly enough to meet warfighter requirements. DoD acquisition can not keep pace with the rate of C4I technology growth and is encumbered by layers of procedural bureaucracy. Subsequently existing Programs of Record were harmed by the resulting non-standard acquisitions. More reform is neither necessary nor the panacea. Adequate processes and programs exist to expedite the fielding of new capabilities. Optimization of existing processes and programs combined with greater warfighter involvement are necessary to prevent future occurrences of non-standard acquisition. Adherence to existing rules and regulations when combined with reduction of bureaucracy will reduce future occurrences of non-standard COTS C4I equipment acquisition and speed the fielding of new capabilities.

DTIC

Command and Control; Intelligence

20080003014 Northwestern Univ., Evanston, IL USA

Adaptive Transceivers for Wireless Spectrum Networks

Honig, Michael L; Aug 21, 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-03-1-0119

Report No.(s): AD-A474081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474081>

This project has been concerned with joint transmitter-receiver adaptation in a distributed, peer-to-peer wireless network. Parameters that can be adapted at the transmitter include rate, power, and signatures in space-time-frequency. In this report we summarize our work on the following topics: (1) Limited feedback schemes for optimizing spatial signatures for Multi-Input Multi-Output (MIMO) channels, and power and rates for multi-carrier transmission; (2) Optimization of training overhead for MIMO block fading channels with least squares filter estimation; (3) Optimization of training overhead with limited feedback for wideband multi-carrier channels, and for a narrowband channel with beamforming; (4) Allocation of training and data power U for a time-selective fading channel with known channel state information; (5) Source-channel coding schemes for block fading channels based on erasure and multi-resolution coding; and (6) Distributed power control for peer-to-peer networks based on the exchange of interference prices. Our main results characterize what channel state information should be exchange between the recover and transmitter (or neighboring transmitters in a distributed network) to provide substantial gains in spectral efficiency.

DTIC

Spectra; Transmitter Receivers

20080003033 Naval Postgraduate School, Monterey, CA USA

Optimum Antenna Configuration for Maximizing Access Point Range of an IEEE 802.11 Wireless Mesh Network in Support of Multi-Mission Operations Relative to Hastily Formed Scalable Deployments

Lounsbury, Jr , Robert L; Sep 2007; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474138; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474138>

To secure a nation, a border, or physical entity, a robust communications system is paramount. Fused, real-time voice, video, and sensor data are enablers in this effort. Building a system that can deliver all of these, with actionable merit, is perhaps the greatest challenge we face in this arena today. The Cooperative Operations & Applied Science and Technology Studies (COASTS) international field experimentation program at the Naval Postgraduate School (NPS) aims to meet this challenge head-on, building a system of systems with technologies available now. A large part of the enabling network for COASTS is an IEEE 802.11 wireless mesh, deployed on the ground, on the sea, and in the air. This thesis tests and evaluates various antenna configurations, using the latest equipment available, building on lessons learned from the COASTS 2005 field experiment. Data is then used to determine the optimum design which allows the greatest range and throughput for the

COASTS 2006 topology. Input from NPS advisors, COASTS commercial partners, including Mesh Dynamics, Mercury Data Systems, and the Air Force Protection Battlelab, along with extensive testing of available antennas over multiple field experiments, culminates in the successful field testing of the 802.11 network topology. The final configuration provides an impressive and highly reliable aerial and ground based access point range and throughput for the network.

DTIC

Antenna Design; Deployment; Local Area Networks; Multipolar Fields; Optimization; Wireless Communication

20080003146 Naval Postgraduate School, Monterey, CA USA

Voice Over Internet Protocol Testbed Design for Non-Intrusive, Objective Voice Quality Assessment

Manka, David L; Sep 2007; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474343; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Voice over Internet Protocol (VoIP) is an emerging technology with the potential to assist the USA Marine Corps in solving communication challenges stemming from modern operational concepts. This thesis conducts a review of VoIP standards and develops an H.323-based testbed for the study of tactical wireless VoIP performance. Methods of collecting and presenting voice quality parameters in packet-based networks are explored. Incorporation of an Adtech SX/14 Data Channel Simulator provides user control of a SONET-simulated wireless channel. Experiments quantify the effect of channel injected error rate on received voice traffic. Plots are generated to illustrate the relationship between channel error rate, packet loss, and the listening quality mean opinion score. Experimental results are extended by incorporating E-model delay considerations. Commercial voice recognition software is successfully used to measure the impact of the channel on speech intelligibility. The experiments and analysis conducted provide a cost effective approach to non-intrusive, objective voice quality assessment.

DTIC

Internets; Nonintrusive Measurement; Protocol (Computers); Speech Recognition; Voice Communication

20080003148 Naval Postgraduate School, Monterey, CA USA

New Pulse Shapes for Enhanced Spectral Efficiency in Digital Radio Communications

Wei, Nga C; Sep 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474346; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Linear modulation schemes such as phase shift keying (PSK) and quadrature amplitude modulation (QAM) are inherently spectrally efficient. This research seeks enhanced spectral efficiency by designing new spectrally efficient pulse shapes for such digital modulations. The pulses designed are of finite duration and exhibit zero intersymbol interference when received through an additive white Gaussian noise (AWGN) channel. It is shown that the resulting communications signals have optimal spectral roll-off while maintaining optimum bit error ratio performance when received via an AWGN channel. The bandwidths and power spectral densities of communications signals using these pulses are compared with traditional spectrally efficient communications signals.

DTIC

Digital Systems; Phase Shift; Pulse Communication; Radio Communication; Shapes; Spectra; Telecommunication

20080003155 Naval Postgraduate School, Monterey, CA USA

Testing and Demonstrating Speaker Verification Technology in Iraqi-Arabic as Part of the Iraqi Enrollment Via Voice Authentication Project (IEVAP) in Support of the Global War on Terrorism (GWOT)

Withee, Jeffrey W; Pena, Edwin D; Sep 2007; 130 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474355; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis documents the findings of an Iraqi-Arabic language test and concept of operations for speaker verification technology as part of the Iraqi Banking System in support of the Iraqi Enrollment via Voice Authentication Project (IEVAP). IEVAP is an Office of the Secretary of Defense (OSD) sponsored research project commissioned to study the feasibility of speaker verification technology in support security requirements of the Global War on Terrorism (GWOT). The intent of this project is to contribute toward the future employment of speech technologies in a variety of coalition military operations by testing speaker verification and automated speech recognition technology in order to improve conditions in the war torn country of Iraq. In this phase of the IEVAP, NPS tested Nuance Inc's Iraqi-Arabic voice authentication application and developed a supporting concept of operations for this technology in support of a new era in Iraqi Banking.

DTIC

Biometrics; Computer Information Security; Iraq; Security; Speech Recognition; Terrorism; Warfare

20080003159 Naval Postgraduate School, Monterey, CA USA

Military Application of Networking by Touch in Collaborative Planning and Tactical Environments

Rideout, Brian T; Strickland, James A; Sep 2007; 153 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474362; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Human Area Networks represent an emerging field of communications technology with the potential to offer significant advantages to military operations. This thesis explores and defines Human Area Networks (HAN) and addresses how HANs relate to existing network topologies as well as the various terminologies associated with HANs. The focus of research addresses the notion of 'touch' as an event and attempts to relate the various interpretations of touch networking to HANs while describing a preliminary architecture through the use of multiple scenarios and use cases, quality attributes, and functional requirements. Additionally, this thesis explores the opportunities associated with one particular implementation of HAN: Intrabody Communications (IBC), and proposes an implementation plan for conceptual IBC devices. Ultimately, this thesis demonstrates the potential value of IBC and HANs in a Joint Tactical scenario with recommendations for iteratively evaluating the techniques, tactics and procedures (TTP) in an incremental manner that seamlessly evolves with technology advancements.

DTIC

Communication Networks; Touch

20080003179 Naval Postgraduate School, Monterey, CA USA

Efficacy of IEEE 802.16 Based Radio-WAN (Wide Area Networks) in Supplementing Satellite Communications in an Intra-Battlegroup and Amphibious Tactical Network

Wren, William E; Sep 2007; 151 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474401; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The concept of Network Centric Warfare (NCW) promises to revolutionize the manner in which warfare and military operations are planned and executed. While many information systems are in development, or currently in production, which seize on the NCW initiative with the goal of enabling USA and coalition military to share information on a scale never before seen, the pace of application development has outpaced that of transmission media development. As information systems become more complex and the amount of information that must be exchanged between units on every level of the military hierarchy has increased, units on the tactical edge that must rely on satellite communications or low bandwidth radio communications will increasingly find themselves on the outside of NCW environment looking in. This research effort will demonstrate the increasing communication needs of naval units within a battlegroup and amphibious distributed operations environment and discuss the significant limitations that these units face with respect to bandwidth and how that affects their ability to efficiently transfer information. This research will also propose a tactical network based on IEEE Standard 802.16 wireless technology as a means of creating a tactical network for use within the battlegroup reducing the reliance on satellites communications to facilitate all of the communications needs of the units. Based on previous research efforts and field experimentation conducted for this research effort, recommendations are also made for improving the protocols contained in IEEE Standard 802.16 to make them even more suitable for use in a tactical environment,

DTIC

Satellite Communication; Telecommunication; Wide Area Networks

20080003787 Naval Postgraduate School, Monterey, CA USA

Design and Implementation of a Mobile Phone Locator Using Software Defined Radio

Larsen, Ian P; Sep 2007; 116 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474043>

This thesis presents an approach for generating, detecting, and decoding a Global System for Mobile Communications (GSM) signal using software defined radio and commodity computer hardware. Using software designed by the GNU free software project as a base, standard GSM packets were transmitted and received over the air, and their arrival times detected. A method is provided to use software analysis of multiple receivers to locate an emitter based on the information received by the software radio. Results and accuracy analysis as well as limitations are shown based on initial testing. Complete implementation source code is provided in the appendices.

DTIC

Mobile Communication Systems; Position (Location); Radio Communication; Time Measurement

20080005240 RAND Corp., Santa Monica, CA USA

Project Air Force Annual Report 2007

Jan 2007; 62 pp.; In English

Report No.(s): AD-A474525; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mission of RAND Project AIR FORCE (PAF), a division of the RAND Corporation and the Air Force's federally funded research and development center for studies and analysis, is to undertake an integrated program of objective, independent analysis on issues of enduring concern to Air Force leaders. PAF carries out its research agenda in four programs that represent core competencies: Strategy and Doctrine seeks to increase knowledge and understanding of geopolitical and other problems in the national security environment that affect Air Force operations. PAF maintains expertise in defense strategy; regional analysis; the objectives and tasks of evolving joint operations; and the potential contributions of air and space power to joint operations, defense planning, and requirements for force development. Aerospace Force Development identifies and assesses ways in which technological advances and new operational concepts can improve the Air Force's ability to satisfy a range of future operational demands. This research involves assessments of technology feasibility, performance, cost, and risk. PAF assesses major force components needed in the future and the systems and infrastructure supporting their operations. Manpower, Personnel, and Training concentrates on questions about workforce size and composition and about the best ways to recruit, train, develop, pay, promote, and retain personnel. PAF's research encompasses the total workforce: active-duty, guard, reserve, civilian, and contractor personnel. Resource Management analyzes policies and practices in the areas of logistics and readiness; outsourcing, privatization, and contracting; the industrial base; planning, programming, and budgeting; infrastructure; and weapon-system cost estimating. The goal of this program is to maximize the efficiency and effectiveness of Air Force operations in a resource-constrained environment.

DTIC

Command and Control; Evaluation; Military Operations; Pilots; System Effectiveness

20080005249 Air Force Research Lab., Wright-Patterson AFB, OH USA

Real-Time Two-Way Time Transfer to Aircraft

Warriner, Jeremy; Beckman, Richard; Celano, Tom; Miller, Mikel; Howe, Peter; Jan 1, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474550; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Two-way time transfer (TWTT) has proven itself as an accurate and reliable method for synchronization over large static baselines. While previous demonstrations have shown the merit of extending TWTT to dynamic platforms, the technology has always been dogged by the fact that it requires specialized equipment and post-processing of the data. If TWTT is to establish itself as a viable means of synchronization between dynamic platforms, it must first demonstrate the ability to operate in real-time with COTS hardware. The most recent airborne test set out to demonstrate this capability and the results of that test are presented herein.

DTIC

Aircraft; Real Time Operation; Telecommunication

20080005264 Congressional Budget Office, Washington, DC USA

Strategic Command, Control, and Communications: Alternative Approaches for Modernization

Hamre, John J; Davison, Richard H; Tarpgaard, Peter T; Oct 1981; 60 pp.; In English

Report No.(s): AD-A474570; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the past two decades, the USA has fielded an extensive collection of facilities and systems designed to direct and control strategic nuclear forces before and during a nuclear war. This strategic command, control, and communications system, referred to as C3, consists of ground-based radars and early-warning satellites; land-based and airborne command centers; and elaborate communications networks. The role of C3 is to alert authorities to a possible attack, permit assessment of the attack's size and targets, and convey the President's orders for retaliation. Despite the importance of these C3 systems, the recent public debate over the adequacy of U.S. nuclear forces has largely overlooked the C3 system, emphasizing instead the need to update the bombers, submarines, and land-based missiles that would deliver strategic weapons. Far less attention has been given to the C3 system, though it has been termed the weakest link in the nation's present strategic forces. The need to make major investments in C3 modernization is considered in some quarters to be an urgent one. Investment in C3 systems in recent years has largely sought to correct deficiencies in current operations and improve performance of existing assets. To that end, the Defense Department is providing 'survivable' ground stations for early-warning satellites, and improving selected command-post aircraft. Compared to the expenditures projected for the offensive strategic forces over the coming 5 years, the costs of modernizing the C3 system are modest. Spending for the nuclear forces could exceed \$130 billion by the end of fiscal

year 1986; the three alternative approaches to C3 modernization would range in cost from \$8.9 billion to \$9.8 billion. The options are as follows: Option I - Improve System Responsiveness in the Trans-Attack Period, Option II - Improve System Endurance in the Post-Attack Period, and Option III - Improve Both System Responsiveness and Endurance.

DTIC

Command and Control; Cost Estimates; Nuclear Warfare

20080005626 Congressional Budget Office, Washington, DC USA

Modernizing U.S. Strategic Offensive Forces: The Administration's Program and Alternatives

Cavaiola, Lawrence J; Dombey, Bonita J; May 1983; 146 pp.; In English

Report No.(s): AD-A474794; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474794>

In October 1981, the Administration announced its plan to modernize all parts of the U.S. strategic deterrent. Representing the most comprehensive and far-reaching such effort in the past 20 years, the plan would expand and upgrade the triad of strategic 'offensive' forces: land-based and sea-based intercontinental ballistic missiles plus long-range bombers. It would also improve the triad's communications and control systems, and strengthen U.S. defenses against attack by Soviet bombers. U.S. strategic forces are primarily intended to deter the Soviet Union from initiating a nuclear war. To do so, they must be able to survive a Soviet nuclear strike and retaliate in an appropriate and timely manner. In recent years, the Soviets have expanded and improved their strategic forces. The Administration apparently believes that in response the USA must increase not only the numbers of its forces and their chance of surviving a Soviet strike, but also their destructive capability, endurance, and responsiveness. The broad scope of the buildup and the relative share of the nation's resources to be devoted to defense in general has sparked debate, as has the high cost of individual weapons systems. Most recently, debate has centered on the Administration's proposal to deploy the MX missile. This study assesses the scope and costs of the Administration's planned modernization, taking into consideration the effects that arms control agreements could have on it. The study also considers proposals to modify the Administration's program by (1) dropping the MX missile, (2) focusing modernization efforts on submarine-based missiles rather than land-based missiles, or (3) terminating the B-1B bomber program in favor of improving existing bomber capability.

DTIC

Alternatives; Management; Telecommunication; Warfare

20080005710 Naval Research Lab., Washington, DC USA

Large Diameter, High Speed InGaAs Receivers for Free-Space Lasercom

Burris, H R; Ferraro, M S; Moore, C I; Goetz, P G; Waters, W D; Clark, W R; Rabinovich, W S; Wasiczko, L M; Suite, M R; Mahon, R; Jan 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474922; NRL-07-1226-0924; XB-NRL/FR/8120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U. S. Naval Research Laboratory (NRL) and OptoGration, Inc. have collaborated in the development and testing of large area, high speed InGaAs avalanche photodiode (APD) receivers for use in free-space lasercom systems. A 200 micron diameter InGaAs APD receiver has been tested in a free-space lasercom testbed and has demonstrated sensitivities of -42.4 dBm at 622 Mbps and -44.8 dBm at 155 Mbps. A 100 micron diameter receiver has been tested with a resulting sensitivity of -35.75 dBm at 2.4883 Gbps. These receivers are made possible due to OptoGration's capability to manufacture a large area, high speed InGaAs APD with an effective ionization ratio of < 0.2 and by matching the APD device with an appropriate transimpedance amplifier and limiting amplifier. Development and testing of the APD receivers will be described below.

DTIC

Avalanche Diodes; High Speed; Indium Gallium Arsenides; Optical Communication; Receivers

20080005716 Naval Research Lab., Washington, DC USA

Cat's Eye Quantum Well Modulating Retro-Reflectors for Free-Space Optical Communications

Rabinovich, W S; Goetz, P G; Mahon, R; Waluschka, E; Katzer, D S; Binari, S C; Biermann, Mark L; Gilbreath, G C; Jan 2003; 12 pp.; In English

Report No.(s): AD-A474931; NRL-03-1226-0047; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Modulating retro-reflectors 'MRR' couple passive optical retro-reflectors with electro-optic modulators to allow free-space optical communication with a laser and pointing/acquisition/tracking system required on only one end of the link. In operation a conventional free space optical communications terminal, the interrogator, is used on one end of the link to

illuminate the MRR on the other end of the link with a cw beam. The MRR imposes a modulation on the interrogating beam and passively retro-reflects it back to the interrogator. These types of systems are attractive for asymmetric communication links for which one end of the link cannot afford the weight, power or expense of a conventional free-space optical communication terminal. Recently, MRR using multiple quantum well 'MQW' modulators have been demonstrated using a large area MQW placed in front of the aperture of a corner-cube. For the MQW MRR, the maximum modulation can range into the gigahertz, limited only by the RC time constant of the device. This limitation, however, is a serious one. The optical aperture of an MRR cannot be too small or the amount of light retro-reflected will be insufficient to close the link. For typical corner-cube MQW MRR devices the modulator has a diameter between 0.5-1 cm and maximum modulation rates less than 10 Mbps. In this paper we describe a new kind of MQW MRR that uses a cat's eye retro-reflector with the MQW in the focal plane of the cat's eye. This system decouples the size of the modulator from the size of the optical aperture and allows much higher data rates. A 40 Mbps device has been demonstrated.

DTIC

Cats; Eye (Anatomy); Free-Space Optical Communication; Modulation; Optical Communication; Quantum Wells; Reflectors; Retroreflectors

20080006139 Industrial Coll. of the Armed Forces, Washington, DC USA

News Media Industry

Anderson, Janet; Buhos, Florentin; Celentano, Ed; Chojjamt, Yadmaa; Cooper, Iris; Daniel, Ed; Do, Nhu-Nga; Feret-Erath, Tara; Escalante, Yori R; Guinee, Paul; Jan 2007; 29 pp.; In English

Report No.(s): AD-A475082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475082>

The ability of US citizens to freely express their views and opinions is a gift we must never take for granted. A key means by which our government and citizens communicate is the News Media. This critical industry is now experiencing tremendous change. Technological advances have led to an explosion in communication media that now provide consumers more news options than ever before. Traditional media such as newspapers, television and radio are being forced to develop digital media in order to maintain and attract a wider customer base. Historical advertising and business models are no longer adequate, but finding a replacement has proven difficult. This critical industry will survive the challenges of today, but the future state of the industry remains uncertain.

DTIC

Industries; News Media

33

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*.

20080002923 Army Construction Engineering Research Lab., Champaign, IL USA

A Direction Finding System for Transient Signals

Swenson, Jr, George W; Pater, Larry L; White, Michael J; Mar 2007; 8 pp.; In English

Report No.(s): AD-A473868; ERDC/CERL-SR-07-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473868>

Currently deployed direction finders used with radio-tagged animals have proved to be of great value in the study of endangered species of wildlife. The automated collection of directional data, supplanting or supplementing individual researchers with hand-held instruments, has permitted major increases in research productivity. However, only one design of a suitable automated instrument exists on the market. It is available from only one source, in limited quantities, and is still in a developmental stage. The current users of this equipment experience much difficulty in achieving the results for which they originally hoped. The authors believe this equipment can eventually be improved in performance and reliability, but it will take much time and effort on the part of the researchers who use it in the field. It is possible to develop a much more capable instrument, based on more modern technical concepts. The resulting instrument should have higher accuracy and reliability, would employ a greatly simplified antenna system and thus be more portable, and, using mainly off-the-shelf components and widely used software, should be more reliable. A collateral benefit of this project would be development of an acoustical direction finder. The same principles apply to sound waves as to radio waves; only the sensors utilize different

physical principles. Existing microphones can be equipped with appropriate baffles to yield the requisite directional properties. The existing sound amplifiers, signal processing software, and data storage facilities can be used. The direction finding algorithms developed for the radio direction finder also can be used for the acoustical case. With the current state of development of digital signal processing techniques it is now possible to deploy electromagnetic and acoustical direction finders capable of enhanced abilities in the detection of transient signals and in determining their directions of arrival.

DTIC

Animals; Digital Systems; Direction Finding; Endangered Species; Precision; Radio Direction Finders; Radio Receivers; Wildlife

20080002927 Ohio State Univ., Columbus, OH USA

Multilayer Reconfigurable GPS Antennas and Platform Effects

Rojas, Roberto G; Sep 2007; 19 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0301

Report No.(s): AD-A473901; FR-746584-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473901>

The work reported here discusses two topics. First, the design and test of a GPS pattern reconfigurable antenna is reported. It is shown through computer simulations and measurements that the beamwidth of the antenna can be changed by turning diode switches on and off. This antenna concept was developed to minimize the effect of interfering signals incident on the antenna along the horizon. This work also shows that microstrip antennas can be fabricated with a thick substrate without the usual surface wave problem. The second topic reported here is the development of the theory of characteristic modes in the time domain. The method described here uses the FDTD technique and has a major advantage over frequency domain algorithms because the resonances of the structure can be captured in a single FDTD run. Examples are given where resonance frequencies as well as characteristic modes are found for several structures, including a printed dipole, a reconfigurable printed antenna and a log-periodic antenna. To validate the proposed method, simulated results and analytical solutions are compared and shown to have excellent agreement.

DTIC

Antennas; Global Positioning System; Method of Moments; Microstrip Antennas

20080002936 Texas A&M Univ., College Station, TX USA

Plasmon Resonators for Quantum Computing

Hemmer, Philip; Jun 2007; 20 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0247; Proj-2305

Report No.(s): AD-A473926; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473926>

The purpose of this project was to develop high-performance plasmon-based nano-optics that can be used to coherently couple single optical emitters to each other or to incoming photons for quantum information applications. The constraint was to fabricate these structures with nanolithographic process such as e-beam lithography, so that precise reproducibility and placement accuracy can be achieved. Initially, the emphasis was on duplicating the performance of fractal-like structures grown by self-assembly. However, difficulties in achieving the necessary sub-5-nm resolution led to the exploration of two other structures. One of these was an infrared LC resonator with an adjustable coupling to the IR field. The motivation for this was to allow optimization of the structure so that an optical version it could be placed on a high Q evanescent optical cavity, without degrading cavity performance. A microwave-frequency version of the structure was first fabricated and tested with a custom near-field probe to validate the simulations. The second structures to be studied were optical wires with normal incidence input/output light coupling structures. Wires with dimensions as low as 50 x 50 nm with lengths up to 15 microns were fabricated. The transmission losses at 632 nm compared favorably to self-assembled metal wires.

DTIC

Plasmons; Quantum Computation; Resonators

20080002965 Air Force Research Lab., Wright-Patterson AFB, OH USA

Investigation of the Self-Pumped Two-Beam Coupling in a Photorefractive Material Using Beam Propagation Simulation (Preprint)

Evans, D R; Cook, G; Carns, J L; Saleh, M A; Banerjee, P P; Jan 2006; 12 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473979; AFRL-ML-WP-TP-2007-501; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473979>

- At this point we are capable of stimulating the self-pumped contra-directional two-beam coupling in a photorefractive medium with arbitrary shaped beams. - Our simulation shows positive role of the photovoltaic effect in self-pumped contra-directional TBC, in agreement with experimental observation.

DTIC

Photovoltaic Effect; Simulation

20080002991 Naval Postgraduate School, Monterey, CA USA

Wirelessly Networked Digital Phased Array: Analysis and Development of a Phase Synchronization Concept

Grahn, Micael; Sep 2007; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474038; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474038>

The ongoing research of a wirelessly networked aperature digital phased array (WNADPA) at NPS has investigated the possibility of using a distributed opportunistic array for radar, where array elements are placed at any available area of the ship structure. This could give an array that is as large as the ship itself, with 360 degrees coverage. It has advantages in the areas of survivability and adaptability, and the profile of the ship could be kept low for better maneuverability and smaller radar cross section. The array elements are stand-alone transmit-receive (T/R) modules controlled over a wireless media, with no hardware connection other than power supply. Phase and time synchronization are critical for the successful operation of the array. The focus of this thesis is on designing a phase synchronization concept, implementing it in existing T/R modules using Commercial of the Shelf (COTS) hardware, and performing validation measurements of the proposed phase synchronization process. The results verify that distribution and phase synchronization of a local oscillator signal over the free space channel are possible.

DTIC

Commercial Off-the-Shelf Products; Phased Arrays; Synchronism; Wireless Communication

20080002996 California Univ., Berkeley, CA USA

Analytical and Practical Analysis of Switched-Capacitor DC-DC Converters

Seeman, Michael D; Sep 1, 2006; 67 pp.; In English

Report No.(s): AD-A474049; UCB/EECS-2006-111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474049>

Switched-capacitor DC-DC converters are useful alternatives to inductor-based converters in many lowpower and medium-power applications. This work develops a straightforward analysis method to determine a switched-capacitor converter's output impedance 'a measure of performance and power loss'. This resistive impedance is a function of frequency and has two asymptotic limits, one corresponding to very high switching frequency where resistive paths dominate the impedance, and one corresponding to very low switching frequency where charge transfers among idealized capacitors dominate the impedance. An optimization method is developed to improve the performance of these converters through component sizing based on practical constraints. Several switched-capacitor converter topologies are compared in the two asymptotic limits. Switched-capacitor converter performance 'based on conduction loss' is compared with that of two magnetics-based DC-DC converters. At moderate to high conversion ratios, the switched capacitor converter has significantly less conduction loss than an inductor-based buck converter. Some aspects of converter implementation are discussed, including the power loss due to device parasitics and methods for transistor control. Implementation using both integrated and discrete devices is discussed. With the correct analysis methods, switched-capacitor DC-DC converters can provide an attractive alternative to conventional power converters.

DTIC

Capacitors; Switching; Voltage Converters (DC to DC)

20080002999 Naval Postgraduate School, Monterey, CA USA

Wireless Networks for Beamforming in Distributed Phased Array Radar

Noris, Jose S; Sep 2007; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474054>

The Wirelessly Networked Aperature Digital Phased Array Radar (WNADPAR) applies three relatively new concepts: Opportunistic, Aperature, and Wirelessly Networked Digital Architecture concepts. Using this approach almost the full length of the ship becomes the aperture of the phased array radar by placing the antenna elements at available open areas and having the power supply as the only wired connection. This thesis research addressed the wireless networking of the full-scale radar system. An analysis of the various existing and newly developed wireless technologies and guided transmission media was conducted to determine a baseline approach for the full system implementation. A two-element array demonstrator was wirelessly networked and tested to allow wireless communication between the central beamformer and controller and the T/R modules. Control and monitoring software was developed in LabVIEW that allows simultaneous transmission and reception in both T/R modules. Finally, a number of tests and measurements were conducted to validate the operation of the two-element array demonstrator while transmitting the control data wirelessly.

DTIC

Antenna Arrays; Beamforming; Communication Networks; Computer Programs; Phased Arrays; Radar Antennas; Wireless Communication

20080003040 Stanford Univ., Stanford, CA USA

InP Transferred Electron Cathodes: Basic to Manufacturing Methods

Pianetta, P; Lee, D; Sun, S; Liu, Z; Spicer, W E; Aug 29, 2007; 139 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0396

Report No.(s): AD-A474166; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474166>

InP has gained an emerging importance as a negative electron affinity (NEA) transferred electron photocathode (TEP) material in imaging technologies. InP provides itself as a substrate to grow these small band gap materials, and also serves as an efficient electron emitter with a low work function at the surface. The high quantum efficiency (QE) of these TEP is realized by depositing Cs and O₂ on the surface of heavily doped p-type semiconductors, where they form the thin activation layer. The atomic structure of this Cs/O activation layer is, however, not well-known, and the properties of photoelectrons from InP-based cathodes also require careful study. In this study, InP photocathodes were studied in three parts: (1) the atomic arrangement of Cs oxides in the activation layer, (2) the decay mechanism of InP photocathodes in an open UHV system and the simulation of commercial sealed photocathode tubes for the elongation of lifetime, and (3) the energy and angular distribution of photoelectrons from InP photocathodes.

DTIC

Manufacturing; Photocathodes; Photoelectrons; Quantum Efficiency; Semiconductors (Materials)

20080003081 Department of the Navy, Washington, DC USA

Acceleration Strain Transducer

Maguire, Jason M, Inventor; Nov 5, 2007; 17 pp.; In English

Report No.(s): AD-D020314; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020314>

An accelerometer is provided including a strain sensor with a substantially linear configuration. The strain sensor is mounted on a transducer such that the strain sensor extends laterally across the transducer. The transducer has a base and a plurality of flaps joined at a first end to the base and supporting the strain sensor at a second end. The flaps translate acceleration in a predefined direction to strain in the strain sensor. Further embodiments have flaps defining an interrupted surface with greater height at the center and flaps that have features for enhancing the strain caused by acceleration.

DTIC

Acceleration (Physics); Patent Applications; Transducers

20080003112 Metas-Swiss Federal Office of Metrology and Accreditation, Bern-Wabern, Switzerland

METAS New Time Scale Generation System - A Progress Report

Bernier, Laurent-Guy; Dudle, Gregor; Schlunegger, Christian; Jan 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474255; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Up to now, UTC (CH) has been defined as a paper time scale which is computed for a single epoch every day: UTC 00:00. In 2006, we have started to phase in the hardware for a new system, still under development, which should allow us to define UTC (CH) as a real time scale generated by a master clock, i.e. a time scale defined for all epochs. The new system should preserve the advantages of the original system while improving reliability, availability, and compatibility with other UTC (k)'s.

DTIC

Universal Time

20080003176 Naval Postgraduate School, Monterey, CA USA

MEMS PolyMUMPS-Based Miniature Microphone for Directional Sound Sensing

Shivok, Timothy J; Sep 2007; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A miniature directional sound sensor was fabricated using micro-electro-mechanical system (MEMS) technology based on the operational principle of Ormia ochracea fly s hearing organ. The fly uses coupled bars hinged at the center to achieve the directional sound sensing by monitoring the difference in vibration amplitude between them. The MEMS sensor design employed in this thesis was fabricated using the PolyMUMPs process. The sound sensor has two primary vibrational modes (rocking

DTIC

Detection; Microelectromechanical Systems; Microphones; Miniaturization

20080003185 Ioffe (A. F.) Physical-Technical Inst., Saint Petersburg, Russian Federation

International Symposium on Nanostructures: Physics and Technology (10th), held on 17-21 June 2002 at St. Petersburg, Russia

Alferov, Zh; Esaki, L; Mar 16, 2005; 649 pp.; In English

Contract(s)/Grant(s): F61775-02-WF037

Report No.(s): AD-A474408; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document is the final proceedings of the 10th International Symposium :Nanostructures: Physics and Technology held 17-21 Jun 2002. Some topics discussed were: Far-infrared and THz phenomena in nanostructures; Nanostructure characterization; Nanostructure technology; Optical and electrical phenomena in nanostructures; Opto- and electronic devices based on nanostructures; Physics of heterostructures with quantum wells and superlattices; Physics of heterostructures with quantum wires and quantum dots; Physics of silicon-based nanostructures; Quantum Computing; Self-organization phenomena in nanostructures; and Single electron phenomena Wide gap materials.

DTIC

Conferences; Electrical Properties; Electronic Equipment; Nanostructures (Devices); Quantum Theory; Russian Federation

20080003356 Joint Inst. for Lab. Astrophysics, Boulder, CO USA

A Long-Term Comparison of GPS Carrierphase Frequency Transfer and Two-Way Satellite Time/Frequency Transfer

Hackman, Christine; Levine, Judah; Parker, Thomas E; Jan 1, 2007; 15 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473920>

GPS carrier-phase frequency transfer (GPSCPFT) and two-way satellite time and frequency transfer (TWSTFT) were performed along three transatlantic links over the 6-month period 29 January 31 July 2006. The GPSCPFT and TWSTFT results were subtracted in order to estimate the combined uncertainty of the methods. The frequency values obtained from GPSCPFT and TWSTFT agreed at 1.8 to 3.8 $10(\text{exp}-16)$ RMS for averaging times of 30 d, with no single value of γ_{GPSCPFT} γ_{TWSTFT} exceeding 5.5 $10(\text{exp}-16)$. These RMS frequency-accuracy values were equal to or less than the frequency-stability values σ_{GPSCPFT} σ_{TWSTFT} (τ) (or TheoBR (τ)) computed for the corresponding averaging times; in general, no frequency bias between GPSCPFT and TWSTFT was observed. The transfer noise of the links varied with time of year, which was especially noticeable in the γ_{GPSCPFT} γ_{TWSTFT} values obtained for 10-15 d averaging times: γ_{GPSCPFT} γ_{TWSTFT} (10 d) sometimes became as large as 2 $10(\text{exp}-15)$.

It is not yet clear what caused these variations. RMS (γ GPSCPFT γ TWSTFT, 10 d) ranged from 0.7 to 1.1 10^{10} (exp-15), with these RMS values approximately equal to $\sigma \gamma$ (GPSCPFT) γ (TWSTFT) ($\tau = 10$ d, 21 h). Day-boundary discontinuities were not removed or otherwise circumvented in this experiment; we hope to reduce the uncertainty at shorter averaging times (e.g., 10 d) through better management of these discontinuities, along with improved understanding of the seasonal components.

DTIC

Frequencies; Global Positioning System; Navigation Satellites; Two Phase Flow

20080005237 Air Force Research Lab., Wright-Patterson AFB, OH USA

Peptide-Assembled Optically Responsive Nanoparticle Complexes

Slocik, Joseph M; Tam, Felicia; Halas, Naomi J; Naik, Rajesh R; Aug 2007; 7 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0021; EEC-0304097; Proj-4348

Report No.(s): AD-A474518; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The design of active nanostructures whose form and properties can be modulated by remote means is an important challenge in nanoscience. Here we report two types of active nanoparticle complexes, with properties controlled by near-infrared illumination, resulting from the assembly of photothermally responsive plasmonic nanoparticles with thermally labile biomolecular linkers. Au nanoshells (NS) and quantum dots (QD) are assembled using coiled-coil peptides into NS-NS and NS-QD complexes. Illumination of the NS-NS complexes results in reversible disassembly reassembly, while illumination of NS-QD complexes results in a large, reproducible modulation of the quantum dot fluorescence without disassembly of the nanoparticle-peptide complex.

DTIC

Nanoparticles; Nanostructures (Devices); Peptides

20080005243 Army Research Lab., Adelphi, MD USA

Microscale Self-Assembled Electrical Contacts

Morris, Christopher J; Sep 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474534; ARL-TR-4298; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Self-assembly, or the spontaneous organization of parts into larger structures via energy minimization, is an attractive solution to overcome packaging and integration challenges. Capillary forces from a molten alloy can be used to both bond microscale components and make electrical connections between them in a self-assembly process. This report presents a systematic study of a number of metal alloys and self-assembly media with the aim of reducing the metal contact size between microscale components. Six different alloys or pure metals with melting points below 160 degrees C and nine different fluids with boiling points over 160 degrees C are considered. Tin-based alloys were generally found to be highly susceptible to corrosion at elevated temperatures above the alloy melting point, with Sn being the primary component to corrode and react with the underlying base metal. Using a eutectic Sn-Bi alloy and glycerol at 180-200 degrees C, the self-assembly of 1500 100-micrometers parts and 500 40-micrometers parts was demonstrated, each in about 2.5 min. Thus, 40 micrometers square, 4 micrometers high contacts were shown to remain functional for self-assembly. The electrical conductance of self-assembled 20 micrometers diameter, 2.5 micrometers high alloy contacts based on this Sn-Bi-glycerol system was measured at 1.9 /m-Omega-sq cm.

DTIC

Bismuth Alloys; Electric Connectors; Microelectronics; Self Assembly; Tin Alloys

20080005335 California Univ., San Diego, La Jolla, CA USA

Novel Magnetic Devices

Schuller, Ivan; Oct 12, 2007; 7 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0739; Proj-05PR08653-00

Report No.(s): AD-A474612; CAGE-50854; EDI/EFT-2259AV; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project was dedicated to the development of novel magnetic devices relevant to applications in the fields of sensors, storage, non-volatile, reprogrammable spin-based electronics. The devices envisioned in this project explored novel physical phenomena and new functionalities not yet explored. More specifically, devices the initial idea was to explore three types of phenomena will be explored: ballistic magnetoresistance, magnetic field proximity effect and spin drag. These three phenomena would then be exploited for the design of novel device architectures and to investigate the physical principles

behind these devices. This project explored the design, preparation, measurement and theoretical study of these novel magnetic devices. Modern thin film techniques (sputtering and Molecular Beam Epitaxy) were used for the growth of the structures. These were combined with state-of-the-art photo and electron beam lithography to engineer the devices. Structural and chemical measurements at the nanoscale were used for characterization, and magnetotransport will be used to investigate their performance. Theoretical work input was used to design the most promising devices and to develop an understanding of the experimental results. More specifically the three general types of devices to be investigated have as key ingredients: Ballistic Magnetoresistance, Magnetic Field Proximity Effect, and Tunneling. These are novel devices that still require scientific basis to validate the science and to help further advances in technology.

DTIC

Magnetic Effects; Magnetoresistivity

20080005336 National Taiwan Univ., Taipei, Taiwan, Province of China

Mid-Infrared MIS Light Emitter from Strained Ge on Si with Nano-Structure Enhancement

Liu, Chee Wee; Nov 20, 2007; 26 pp.; In English

Contract(s)/Grant(s): FA520905P0473

Report No.(s): AD-A474613; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project involved the observations of near-infrared emissions from Si/Ge heterojunctions and Ge quantum dot metal-oxide-semiconductor light-emitting diodes.

DTIC

Augmentation; Emitters; Light Emitting Diodes; Nanostructure (Characteristics); Near Infrared Radiation; Semiconductor Devices

20080005539 NASA Glenn Research Center, Cleveland, OH, USA

Silicon Carbide Sensors and Electronics for Harsh Environment Applications

Evans, Laura J.; December 13, 2007; 18 pp.; In English; Sensors World Conference, 12 Dec. 2007, Williamsburg, VA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.19.05; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005539>

Silicon carbide (SiC) semiconductor has been studied for electronic and sensing applications in extreme environment (high temperature, extreme vibration, harsh chemical media, and high radiation) that is beyond the capability of conventional semiconductors such as silicon. This is due to its near inert chemistry, superior thermomechanical and electronic properties that include high breakdown voltage and wide bandgap. An overview of SiC sensors and electronics work ongoing at NASA Glenn Research Center (NASA GRC) will be presented. The main focus will be two technologies currently being investigated: 1) harsh environment SiC pressure transducers and 2) high temperature SiC electronics. Work highlighted will include the design, fabrication, and application of SiC sensors and electronics, with recent advancements in state-of-the-art discussed as well. These combined technologies are studied for the goal of developing advanced capabilities for measurement and control of aeropropulsion systems, as well as enhancing tools for exploration systems.

Author

Semiconductors (Materials); Silicon Carbides; Electronics; Fabrication; Pressure Sensors; Microelectromechanical Systems

20080005610 Pohang Univ. of Science and Technology, Pohang, Korea, Republic of

Fabrications and Characterizations of ZnO/Zn_{1-x}Mg_xO Nanorod Quantum Structures

Yi, Gyu-Chul; May 15, 2007; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474747; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474747>

Semiconductor nanorod heterostructures open up significant opportunities for fabrication of electronic and photonic nanodevices on single nanorods. The semiconductor nanorod quantum structures with well-defined interfaces are main components for nanoscale resonant tunneling devices, field effect transistors, and light-emitting devices since the nanorod quantum structures (Qs) enable novel physical properties such as quantum confinement and formation of minibands. In particular, spectral wavelength can be tuned by varying the well thickness, and the light emission efficiency is significantly enhanced at room temperature. However, quantum confinement effects in nanowires/nanorod heterostructures have not been easily observed despite recent synthesis of compositionally modulated nanowire superlattices by the vapor liquid solid (VLS) growth process. This may result from the relatively broad heterostructure interfaces caused by realloying of alternating

reactants in the metal catalyst during the condensation-precipitation process. In that case, abrupt interfaces can be obtained using our catalyst-free nanorod heteroepitaxial growth technique. This nanorod growth method makes it possible to control the thickness of each layer within the monolayer level by utilizing direct adsorption of atoms on the surface of nanorods. We demonstrated this by the fabrication of ZnO/MgZnO nanorod QSs which exhibit the clear signature of quantum confinement, an increasing blue shift with decreasing layer thickness. In this research, we investigated luminescent characteristics of a single nanorod QS including ZnO/MgZnO coaxial nanorod single-quantum-wells and ZnO/MgZnO nanorod double-quantum-wells using photoluminescence and cathodoluminescence spectroscopy. In addition, we demonstrated nanophotonic switch based on the coupling behavior between optical near-field and ZnO/MgZnO nanorod double-quantum-wells.

DTIC

Energy Transfer; Fabrication; Nanorods; Quantum Wells; Zinc Oxides

20080005613 Pohang Univ. of Science and Technology, Pohang, Korea, Republic of

Synthesis of Si Nanowires for an Anode Material of Li Batteries

Lee, Kun-Hong; Dec 4, 2007; 31 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0092

Report No.(s): AD-A474750; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474750>

The work encompassed the study of new alloy anode material for the next generation of Li ion battery. The alloy includes Li alloy with Sn, Al and Si. It has been reported that the Li_{4.4}Si alloy can have the theoretical capacity of 4200 mAh/g, which is much higher than the capacity of the graphite. However, in spite of the theoretical prediction, the immense volume increase, thus capacitance decrease occurred during charging and discharging. Therefore, the work focused on the study of morphological and volume change of the Li Si alloy electrodes. The result of the study is expected to contribute to the future work of the Li alloy anode development for the improved capacitance.

DTIC

Anodes; Electric Batteries; Lithium Batteries; Nanowires; Silicon; Silicon Alloys; Tin Alloys

20080005694 Army Research Lab., Adelphi, MD USA

Simulation of Air Flow Through a Test Chamber

Ovrebo, Gregory K; Dec 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474879; ARL-MR-0680; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Computer simulation was used to investigate the flow of forced air through a test chamber used to measure heat dissipated by an inductor. Cosmos FloWorks simulations provide a qualitative picture of the air stream passing through the chamber, as well as calculations of air velocity at the chamber outlet port. These results provide a correction factor for measurements of power dissipation in high-power electric components.

DTIC

Air Flow; Computerized Simulation; Inductors; Simulation; Test Chambers

20080005717 Naval Research Lab., Washington, DC USA

Progress in Development of Multiple-Quantum-Well Retromodulators for Free-Space Data Links

Gilbreath, G C; Rabinovich, William S; Meehan, Timothy J; Vilcheck, Michael J; Stell, Mena; Mahon, Rita; Goetz, Peter G; Oh, Eun; Vasquez, John A; Cochrell, Kerry; Lucke, Robert L; Mozersky, Sharon; Jun 2003; 8 pp.; In English

Report No.(s): AD-A474932; NRL-03-1226-0036; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present an update on the progress of the development of the Naval Research Laboratory's (NRL's) multiple-quantum-well retromodulators for compact, low-power communications. We report results for data-in-flight on a small, unmanned aerial vehicle at up to 5 Mbps, in preparation for real-time video transfer using an array of devices. This data was taken at Chesapeake Bay Detachment. We also report transference of color video using wavelet compression at 15 and 30 frames/s, at 4 to 6 Mbps in the lab, at eye-safe intensity levels. The unit is a corner cube modulator using a 980-nm shutter. A five-element array was used for the data-in-flight. First results of our 1550-nm devices are also presented as progress in a 'cat's eye retromodulator.'

DTIC

Data Links; Modulators; Progress; Quantum Wells

20080005818 Idaho Univ., Moscow, ID USA

Magnetic Random Access Memory for Embedded Computing

Donohoe, Gregory W; Oct 29, 2007; 212 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9453-04-1-0206; Proj-5159; Proj-181

Report No.(s): AD-A474844; MRAM_II_2007-FINAL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this research was to develop an embedded magnetic memory technology to be integrated into Complementary Metal Oxide Semiconductor (CMOS) integrated circuit fabrication process to provide radiation-hard, logic elements and small random-access memories. The goal is not to provide large scale, bulk memory, but latches and flip flops that serve as state and data registers for sequential logic, and configuration registers for configurable logic. The benefits to spacecraft systems include the ability to power-down a subsystem while retaining system state, thus saving energy until the subsystem is required. The subsystem can then be powered-up and begin operating in milliseconds. The technology is based on a unique, PacMan-shaped magnetic tunneling junction (MTJ) cell developed at the University of Idaho. The focus of this research is to refine the PacMan cell to make it practical for integration into CMOS circuits, to develop CMOS circuits that employ the magnetic cells, and to integrate the cells onto a CMOS process. The process produced two circuit designs based on magnetic memory elements: a magnetic latch, and a magnetic shadow memory to serve as a backup to volatile electronic memory.

DTIC

Circuits; CMOS; Computer Storage Devices; Embedding; Magnetic Storage; Memory (Computers); Random Access; Random Access Memory

20080005827 Air War Coll., Maxwell AFB, AL USA

Next Generation Nanotechnology Assembly Fabrication Methods: A Trend Forecast

Jovene, Jr, Vincent T; Jan 2008; 46 pp.; In English

Report No.(s): AD-A474838; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Today, the continued success of many industries, especially the microelectronics industry, relies upon the ability to fabricate structures with nanometer precision. The efforts toward developing nanometer-scale fabrication methods fall loosely into two fields. One field seeks to extend the current planar, deposit-pattern-etch paradigm used for complementary metal oxide semiconductors (CMOS). This is a top-down approach. The other seeks new techniques to assemble structures without handling individual particles: self-assembly. These techniques take a bottom-up approach. The fundamental limits of the materials used in the planar CMOS process, which has been the basis for the semiconductor industry for the past 30 years, are now being reached. This is driving industry to fund research to find new fabrication methods. The thesis of this paper is that as new fabrication methods are mastered in the quest to continue advancement in computer processing, these techniques will propagate to other applications with the potential to threaten U.S. national security interests.

DTIC

Fabrication; Forecasting; Industrial Management; Nanostructures (Devices); Nanotechnology; Self Assembly; Self Organizing Systems

20080005834 Stanford Univ., Stanford, CA USA

Excitation of the Magnetospheric Cavity

Bell, Timothy F; Kulkarni, Prajwal; Jun 16, 2007; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-03-C-0059; Proj-1010

Report No.(s): AD-A474765; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474765>

Stanford University carried out a detailed study of the following topics: 1) the optimum orbit for exciting the magnetospheric cavity resonance by a space-based ELF/VLF transmitter, 2) the antenna type and configuration necessary to excite various cavity modes with the radiated ELF/VLF waves, 3) the effects of Landau damping on the ELF/VLFL waves within the cavity, 4) the effectiveness of the radiated ELF/VLF cavity waves in precipitating energetic radiation belt particles, and 5) the optimum spacecraft orbit, antenna configuration, and ELF/VLF transmitter frequency spectmm for precipitating energetic radiation belt particles over a wide range of energies. In addition, a study was carried out concerning the excitation of the magnetospheric cavity by ground-based VLF transmitters.

DTIC

Antenna Design; Cavities; Excitation; Extremely Low Frequencies; Radiation Belts; Transmitters; Very Low Frequencies

20080006066 NASA Glenn Research Center, Cleveland, OH, USA

Compatibility of Ionic Liquid Containing Rod-Coil Polyimide Gel Electrolytes with Lithium Metal Electrodes

Tigelaar, Dean M.; Palker, Allyson E.; Bennett, William R.; [2008]; 12 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC062A46A; WBS 561581.02.08.03.15.03; Copyright; Avail.: Other Sources

Highly conductive rod coil polyimide-poly(ethylene oxide) electrolytes were made that contained varying amounts of room temperature ionic liquid (RTIL), lithium trifluoromethanesulfonimide (LiTFSi), and alumina nanoparticles. Electrochemical stability of these electrolytes with lithium metal electrodes was studied by galvanic cycling and impedance spectroscopy. Improved cycling stability and decreased interfacial resistance were observed when increasing amounts of RTIL and LiTFSi were added. The addition of small amounts of alumina further decreased interfacial resistance by nearly an order of magnitude. During the course of the study, cycling stability increased from <3 hours to >1000 hours at 60 C and 0.25 mA/sq cm current density.

Author

Lithium Batteries; Electrolytes; Polyimides; Current Density; Nanoparticles

20080006075 Air Force Research Lab., Wright-Patterson AFB, OH USA

Photovoltaic Induced Grating Instabilities (Preprint)

Evans, D R; Cook, G; Carns, J L; Saleh, M A; Feb 2006; 9 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474956; AFRL-ML-WP-TP-2007-500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474956>

The PV field is responsible for undesirable grating recording noise, or spikes in transmitted power. Corresponding spikes in the transmission of light incident at the Bragg angle indicate the grating is partially destroyed rather than momentarily dephased. The noise is most likely due to a sudden strong current and/or avalanche current flow through the bulk crystal, such that the E_{sc} is randomized and the grating is partially destroyed.

DTIC

Nonlinear Optics; Stability

20080006106 Air Force Research Lab., Wright-Patterson AFB, OH USA

Photoexcited-Carrier-Induced Refractive-Index Change in Small Band-Gap Semiconductors (Preprint)

Yu, Z G; Krishnamurthy, S; Guha, Shekhar; Jan 2006; 14 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475004; AFRL-ML-WP-TP-2007-522; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475004>

Using accurate band structures of InAs, InSb, and two $Hg_{1-x}Cd_xTe$ alloys, we calculate the change in refractive index caused by the photoexcited electrons and holes. Both free-carrier absorption (FCA) and one-photon absorption are considered. Contrary to current assumptions, we find that the change in refractive index varies nonlinearly with the density of photoexcited carriers and that the FCA may have a significant contribution to the refractive-index change in materials like InAs, where the energy difference between the heavy-hole and light-hole bands is small because of a weak spin-orbit coupling.

DTIC

Band Structure of Solids; Energy Gaps (Solid State); Photoconductivity; Photoexcitation; Refractivity; Semiconductors (Materials)

20080006108 Air Force Research Lab., Wright-Patterson AFB, OH USA

Photoexcited-Carrier-Induced Refractive-Index Change in Small Band-Gap Semiconductors (Preprint)

Yu, Z G; Krishnamurthy, S; Guha, Shekhar; Aug 2006; 15 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475006; AFRL-ML-WP-TP-2007-532; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475006>

Using accurate band structures of InAs, InSb, and two $Hg_{1-x}Cd_xTe$ alloys, we calculate the change in refractive index

caused by the photoexcited electrons and holes. The effect of both free-carrier absorption (FCA) and one-photon absorption are considered. We find that the change in refractive index varies nonlinearly with the density of photoexcited carriers and that the generally neglected FCA contribution is significant in InAs, owing to its weak spin-orbit coupling.

DTIC

Band Structure of Solids; Energy Bands; Energy Gaps (Solid State); Photoconductivity; Photoexcitation; Refractivity; Semiconductors (Materials)

20080006125 Army Research Lab., Adelphi, MD USA

Functional Test Results of a High Power Patch Array Antenna

Ly, Canh; Jan 2008; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475036; ARL-TR-4352; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475036>

Mechanical and electrical test results of a high power two-patch array antenna [ARL Invention pending ARL-07-18, Ly, et al.] are presented. The mechanical test was run for 55 minutes for each axis of the antenna. The electrical test was conducted using a high power RF source (>1 KW) with single and two-patch array antennas. Although the first mechanical test results indicated that the screws of the antenna cover are loosened about 1/4 turn, and right angle connectors inside the antenna enclosure box were loosened about a fraction of a turn, the antenna still sustained all functional operations. The antenna uses air dielectric to endure a high average power for the system that operates at S-Band in order to neutralize unattended microwave devices. This development is to fulfill part of the Army Technology Objective (ATO), Network Centric Warfare for the U.S. Army Communications-Electronics Research, Development, and Engineering Center (CERDEC), and Research and Development Engineering Command (RDECOM).

DTIC

Antenna Arrays; Patch Antennas

20080006126 Industrial Coll. of the Armed Forces, Washington, DC USA

Electronics Industry

Ginter, Michael J; Andersen, James L; Becker, John A; Belliveau, Gerald E; Eppich, Frank J; Awai, Herman T; Hanco, David J; Hughes, Bob; Jones, Douglas; Larson, Kelly J; Jan 2007; 31 pp.; In English

Report No.(s): AD-A475040; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475040>

This report is an analysis of a critical U.S. sector by the fellows of the Electronics Industry Seminar at the Industrial College of the Armed Forces (ICAF), Class of 2007. The report is the culmination of a focused series of classroom seminar sessions and meetings with industry, government, and academic leaders through field studies in the metropolitan Washington, D.C. area, New York State, Silicon Valley (California), Taiwan, and China. This approach provides a wide range of perspectives from which to examine the selected industry's current condition, outlook, and challenges. The electronics industry, fueled largely by semiconductors, is one of the largest and fastest growing industries in the world. Advances in this industry increased productivity and led to numerous innovations in science, education, healthcare, and other industries across all sectors of the U.S. economy. U.S. leadership in the industry propelled economic growth and enabled the country to lead the world in innovation and advanced military technologies. In recent years, however, an increasing number of global semiconductor activities have shifted to Asia. This change is beginning to threaten U.S. defense supplies and technological advantages, and weaken the country's economic strength in technology-based industries. The report recommends policies to counter or mitigate this trend and achieve goals related to national security, industry competitiveness, or both. In general terms, the government needs to protect key technologies, enforce fair trade agreements, stimulate innovative capacity, and enhance the business environment for semiconductor companies in America.

DTIC

Competition; Electronic Equipment; Industries; Military Technology; Protection; Semiconductors (Materials); Technology Assessment

20080006142 Air Force Research Lab., Wright-Patterson AFB, OH USA

High Intensity Light Propagation in InAs (Preprint)

Guha, Shekhar; Gonzalez, Leo; Krishnamurthy, Srinivasan; Yu, Zhi G; Jun 2006; 11 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475098; AFRL-ML-WP-TP-2007-538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475098>

We present our experimental and theoretical results on nonlinear absorption of light in InAs. The nonlinear variation of output intensity as a function of input intensity and time are calculated by solving four coupled rate equations simultaneously. All required quantities, including two-photon absorption, free-carrier absorption, Auger and radiative recombination lifetimes, and intrinsic carrier densities, have been obtained from the underlying band structures. The calculated thickness and energy-dependent output intensities in InAs agree very well with the values measured in our pump-probe experiments.

DTIC

Absorption; Indium Arsenides; Light Transmission

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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*.

20080003000 Army Research Lab., Aberdeen Proving Ground, MD USA

Computational Fluid Dynamics Results for a 25-mm Projectile

Heavey, Karen; Sahu, Jubaraj; Sep 2007; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474057; ARL-MR-676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474057>

Computational fluid dynamics approaches were used to compute the flow fields of a 25-mm projectile, modeled with and without a jet cavity. Steady-state numerical results have been obtained for a series of cases at Mach number 0.756, at 0 deg angle of attack, with jet pressures of 3, 6, and 12 atm. Full three-dimensional computations were performed using a two-equation realizable k-epsilon turbulence model. Force and moment data have been extracted from the solutions for comparison and show that increasing jet pressure increases the effect on normal force and pitching moment while having little effect on drag.

DTIC

Computational Fluid Dynamics; Projectiles

20080003165 Naval Postgraduate School, Monterey, CA USA

Structure and Dynamics of the Thermohaline Staircases in the Beaufort Gyre

Wilson, Ana L; Sep 2007; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474381; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study explores the dynamics of diffusive convection which occurs when cold, fresh water overlies warm and salty. The primary convective regime in the Arctic region is characterized by the spontaneous formation of well mixed layers separated by thin high-gradient interfaces known as thermohaline staircases. Data analysis and analytical considerations are used to estimate the vertical heat/salt mixing rates and their dependencies on the large-scale environmental parameters. Based on the analysis of Beaufort staircases, we suggest that the layer thickness, as well as the vertical heat/salt fluxes, is controlled by the patterns of merging events in which relatively small steps are systematically eliminated. Significant concerns are raised with regard to the direct extrapolation of laboratory derived flux laws to ocean conditions. An alternative method of analysis is proposed which involves recalibration of the laboratory-derived flux laws for the oceanic conditions. Extrapolated diffusive convective fluxes are in the range of 1-6 Wm^{-2} , comparable to magnitude of fluxes currently unaccounted for in the Arctic heat budget. We propose that the parameterizations of the diffusive fluxes in thermohaline staircases can be used to enhance understanding of Arctic climate changes and predictive capabilities of large-scale numerical models. Preliminary findings are

indicative of the importance of diffusive convection for sound propagation in the Arctic region the problem of great interest for various Naval research applications in the area.

DTIC

Arctic Regions; Beaufort Sea (North America); Cold Water; Convection; Diffusivity; Gyres; Oceans; Stairways; Thermodynamic Properties

20080003182 Naval Surface Warfare Center, Bethesda, MD USA

Experiment to Characterize Sea Fighter FSF-1 Wave Slamming

Minnick, Lisa M; Fu, Thomas C; Fullerton, Anne M; Anderson, Kirk; Walker, Don C; Jun 2007; 59 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-WX2-0691

Report No.(s): AD-A474405; NSWCCD-50-TR-2007/030; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the data obtained from a field experiment to obtain full-scale qualitative and quantitative wave slamming data of the Sea Fighter (FSF-1), a high-speed experimental vessel developed by the Office of Naval Research. A 4-day trial from April 18-21, 2006 was conducted which began in Port Angeles, WA and ended in San Diego, CA. This data includes measurement of the ambient environmental conditions (wind and waves) in which the ship was operating, including the incident waves impacting the vessel, ship motions (including accelerations and angular rates), and visual documentation of the wave field surrounding the ship. This data will be used in the development and validation of computational tools used for design and evaluation of high-speed ships.

DTIC

Seas; Slamming

20080003357

Induced Forces and Moments of a Tumblehome Hullform (Model 5613) Undergoing Forced Roll in Waves

Fullerton, Anna M; Fu, Thomas C; Walker, Don C; Rice, James R; Nov 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-WX-20710

Report No.(s): AD-A474393; NSWCCD-50-TR-2007/044; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Predictions of large amplitude roll motions and capsize events have proven to be difficult and include large uncertainty. A factor that contributes to the difficulty in predictions is a lack of knowledge of resultant forces and moments for large roll angles. The equations currently used by numerical models to predict forces and moments due to roll motion are based on experimental data performed within a small range of roll amplitudes. For this reason, a data set of forces and moments is needed to verify that the model predictions are accurate in the upper ranges. If the predictions are inaccurate for the larger roll angles, a need may exist to develop new modes to predict the forces and moments for these larger roll amplitudes. In 2006, NSWCCD performed an experiment on Model 5613 to obtain the model scale constrained seakeeping results during large amplitude motions in waves, in contrast to the calm water experiments of 2005. Similar to the 2005 experiment, the effects of model speed, roll amplitude roll frequency, wave height and wave len on the forces and moments were investigated in an effort to develop a database of surge, sway, and heave forces, and roll, itch and yaw moments as a result of flare amplitude forced roll motions in waves. This report will describe the experimental setup and results of the 2006 experiment.

DTIC

Roll; Mathematical Models; Hulls (Structures); Motion

20080003842 NASA Marshall Space Flight Center, Huntsville, AL, USA

New Methods for the Adsorption of Carbon Dioxide and Water Vapor from Manned Spacecraft Atmospheres: Application and Modeling

Knox, James; Howard, D.; October 04, 2007; 29 pp.; In English; COMSOL Conference 2007 (COMSOL, Inc.), 4-6 Oct. 2007, Newton, MA, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: [A03](#),

Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003842>

This viewgraph presentation describes new methodologies for carbon dioxide and humidity removal from manned

spacecraft atmospheres. The mathematical modeling of various adsorbents is also presented.

CASI

Adsorption; Carbon Dioxide Removal; Manned Spacecraft; Mathematical Models; Water Vapor; Fluid Flow

20080005216 Army Research Lab., Adelphi, MD USA

Fabrication and Testing of a Novel MEMS Rotational Thermal Actuator

Gee, Danny; Currano, Luke; Nov 2007; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474473; ARL-TR-4315; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The fabrication and testing of a micromachined thermal rotational actuator are presented in this report. The actuator is designed to realize the high forces and large displacements that are difficult to achieve with microelectromechanical system actuators. The device uses asymmetry to produce a desired rotational deflection, making it well suited for rotary engines or biologically inspired joint movement. The focus of the project was to compare measured and theoretical values of spring constants of the devices, since spring constant relates force and displacement. These measurements both characterize actuator performance for comparisons with other actuators and provide a basis for optimal design of this type of actuator for any given application. An early test of the rotational actuators showed a displacement of 12.7 micrometers with 637 milliNewtons (mN) of force requiring 250 mW of power.

DTIC

Actuators; Fabrication; Microelectromechanical Systems

20080005225 Science and Technology Applications, LLC, Moorpark, CA USA

Impact of L/D on 90 Degree Sharp-Edge Orifice Flow with Manifold Passage Cross Flow (Preprint)

Nurick, W H; Ohanian, T; Talley, D G; Strakey, P A; Apr 30, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A474490; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A process model is proposed to explain the various stages of flow conditions that are observed by measurement as the flow transitions from non-cavitation to cavitation (turbulent flow), supercavitation, and finally separation in sharp-edge 90 degree orifices. This study includes orifice L/D from 1 to 10, orifice diameters of nominally 0.048 and 0.078 inch, and upstream pressures from 100 to 1500 psi as well as manifold cross flow velocity of from 6 to 60 ft/sec. The results support two different first order models, one for cavitation and the other non-cavitation in turbulent flow. Under full cavitation conditions the discharge coefficient is related to the contraction coefficient and the cavitation number to the 1/2 power. In the non-cavitation full flow regime the head loss is related to the loss coefficient and the dynamic pressure at the orifice exit. Both the head loss and contraction coefficient were found to be a strong function of the ratio of upstream velocity-to-orifice exit velocity. The area ratio between the manifold and the orifice were also found to have a significantly influence the contraction coefficient. Relationships are proposed to explain the processes leading to hydraulic flip (separation) and prediction of occurrences that include inception of cavitation, supercavitation, and separation.

DTIC

Cross Flow; Orifice Flow; Orifices; Rocket Engines

20080005252 Army Research Lab., White Sands Missile Range, NM USA

White Sands Missile Range 2007 Urban Study: Flow and Stability Around a Single Building Volume 1: Field Study Overview

Vaucher, Gail; Bustillos, Manuel; Brice, Robert; D'Arcy, Sean; Cionco, Ron; Chamberlain, Felicia; Trammel, Joseph; Luces, Saba; Padilla, Richard; Yarbrough, Jimmy; Sep 2007; 46 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474554; ARL-TR-4255; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this Field Study Overview, we (1) describe the foundational scientific and engineering aspects of the airflow and stability field study and (2) provide an administrative report on the field study execution with its associated research application drills. The six mission objectives driving this project were derived from three general areas: urban atmosphere research, technology advancements and research applications. The preliminary results section summarizes the objective successes. The technical report concludes with comments that describe the many beneficiaries of this field study/research work.

DTIC

Air Flow; Flow Stability; Missile Ranges

20080005325 Washington Univ., Seattle, WA USA

Internal Tide Generation by Steep Topography

Kunze, Eric; Sanford, Thomas; Sep 2007; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0212

Report No.(s): AD-A474598; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this proposal was to support Dr. Eric Kunze, Applied Physics Laboratory, University of Washington (now at University of Victoria) and Dr. Pascale Lelong (via a subcontract to Northwest Research Associates, Seattle, Washington) to numerically explore an alternative solution method to Baines' (1982) internal tide generation theory for arbitrary 1-D topography $h(x)$. The solution method uses characteristic coordinates along which signals of frequency ω propagate.

DTIC

Internal Waves; Ocean Bottom; Oceans; Tides; Topography

20080005341 Minnesota Univ., Minneapolis, MN USA

Fitness-for-Purpose Evaluation of Hydraulic Steel Structures

Dexter, Robert J; Mahmoud, Hussam N; Padula, Joseph A; Riveros, Guillermo A; Nov 2007; 81 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W912HZ-04-P-0235

Report No.(s): AD-A474623; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hydraulic structures such as locks, spillway gates, and maintenance closure structures may have fabrication defects and flaws that can be large enough to threaten the integrity of the structure. In addition, some defects that are not allowed based on stringent specifications are not at all harmful to the structure. Fitness-for-purpose evaluation is a method for determining a factor of safety against fracture and the risk of collapse in existing structures. This report discusses the different types of hydraulic steel structures, typical fatigue cracks that could exist in such structures, and details that could lead to brittle fracture. Using steps developed by the British Standards Institute, the report describes a fitness-for-purpose evaluation procedure for hydraulic control structures under Mode I loading, including how large a crack-like discontinuity would have to be before it could lead to fracture in a typical steel member.

DTIC

Hydraulic Equipment; Steel Structures

20080005552 NASA Glenn Research Center, Cleveland, OH, USA

Aerodynamic Inner Workings of Circumferential Grooves in a Transonic Axial Compressor

Hah, Chunill; Mueller, Martin; Schiffer, Heinz-Peter; December 02, 2007; 8 pp.; In English; 2007 International Gas Turbine Congress (IGTC), Dec. 2007, Tokyo, Japan; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.21.02

Report No.(s): IGTC2007-ABS-55; Copyright; Avail.: CASI: [A02](#), Hardcopy

The current paper reports on investigations of the fundamental flow mechanisms of circumferential grooves applied to a transonic axial compressor. Experimental results show that the compressor stall margin is significantly improved with the current set of circumferential grooves. The primary focus of the current investigation is to advance understanding of basic flow mechanics behind the observed improvement of stall margin. Experimental data and numerical simulations of a circumferential groove were analyzed in detail to unlock the inner workings of the circumferential grooves in the current transonic compressor rotor. A short length scale stall inception occurs when a large flow blockage is built on the pressure side of the blade near the leading edge and incoming flow spills over to the adjacent blade passage due to this blockage. The current study reveals that a large portion of this blockage is created by the tip clearance flow originating from 20% to 50% chord of the blade from the leading edge. Tip clearance flows originating from the leading edge up to 20% chord form a tip clearance core vortex and this tip clearance core vortex travels radially inward. The tip clearance flows originating from 20% to 50% chord travels over this tip clearance core vortex and reaches to the pressure side. This part of tip clearance flow is of low momentum as it is coming from the casing boundary layer and the blade suction surface boundary layer. The circumferential grooves disturb this part of the tip clearance flow close to the casing. Consequently the buildup of the induced vortex and the blockage near the pressure side of the passage is reduced. This is the main mechanism of the circumferential grooves that delays the formation of blockage near the pressure side of the passage and delays the onset of short length scale stall inception. The primary effect of the circumferential grooves is preventing local blockage near the pressure side of the blade leading edge that directly determines flow spillage around the leading edge. The circumferential grooves do not necessarily reduce the overall blockage built up at the rotor tip section.

Author

Transonic Compressors; Compressors; Fluid Mechanics; Turbocompressors; Data Simulation; Rotating Stalls; Grooves

20080005667 North Carolina State Univ., Raleigh, NC USA

Computational Simulation of High-Speed Projectiles in Air, Water, and Sand

Edwards, Jack R; Dec 3, 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0224

Report No.(s): AD-A474817; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development of a comprehensive computational fluid dynamics approach for conducting simulations of projectile penetration into water-saturated sand is reported. High resolution upwind schemes suitable for a fluid dynamic system consisting of gas, liquid, and dispersed solids phases are derived and are combined with a time-derivative preconditioning strategy for efficient time integration at all flow speeds. A solids-stress model based on Mohr-Coulomb critical-state theory is used to account for compaction and deformation of sand during projectile penetration. An overset-mesh framework is also implemented in order to handle projectile relative motion in subsequent work, and improved phase interface capturing methods are also developed and tested. Results are presented for two sets of experimental data involving projectile penetration into dry sand. The computational results are sensitive to the solids-stress model and the drag coefficient predictions are generally lower than indicated in the experimental data.

DTIC

Computational Fluid Dynamics; High Speed; Projectiles; Sands; Simulation; Water

20080006054 NASA Glenn Research Center, Cleveland, OH, USA

Stirling System Modeling for Space Nuclear Power Systems

Lewandowski, Edward J.; Johnson, Paul K.; June 27, 2007; 16 pp.; In English; Space Nuclear Conference 2007 (SNC-2007), 24-28 Jun. 2007, Boston, MA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC07TA38T; NAS3-0015; WBS 463169.04.03; Copyright; Avail.: CASI: [A03](#), Hardcopy

A dynamic model of a high-power Stirling convertor has been developed for space nuclear power systems modeling. The model is based on the Component Test Power Convertor (CTPC), a 12.5-kWe free-piston Stirling convertor. The model includes the fluid heat source, the Stirling convertor, output power and heat rejection. The Stirling convertor model includes the Stirling cycle thermodynamics, heat flow, mechanical mass-spring damper systems, and the linear alternator. The model was validated against test data. Both nonlinear and linear versions of the model were developed. The linear version algebraically couples two separate linear dynamic models; one model of the Stirling cycle and one model of the thermal system, through the pressure factors. Future possible uses of the Stirling system dynamic model are discussed. A pair of commercially available 1-kWe Stirling convertors is being purchased by NASA Glenn Research Center. The specifications of those convertors may eventually be incorporated into the dynamic model and analysis compared to the convertor test data. Subsequent potential testing could include integrating the convertors into a pumped liquid metal hot-end interface. This test would provide more data for comparison to the dynamic model analysis.

Author

Spacecraft Power Supplies; Stirling Cycle; Dynamic Models; Nuclear Models; Heat Sources; Linear Alternators; Thermodynamics

20080006056 NASA Glenn Research Center, Cleveland, OH, USA

Assessment of the National Combustion Code

Liu, nan-Suey; Iannetti, Anthony; Shih, Tsan-Hsing; October 30, 2007; 32 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.16.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The advancements made during the last decade in the areas of combustion modeling, numerical simulation, and computing platform have greatly facilitated the use of CFD based tools in the development of combustion technology. Further development of verification, validation and uncertainty quantification will have profound impact on the reliability and utility of these CFD based tools. The objectives of the present effort are to establish baseline for the National Combustion Code (NCC) and experimental data, as well as to document current capabilities and identify gaps for further improvements.

Author

Computational Fluid Dynamics; Combustion Chemistry; Combustion; Reaction Kinetics

20080006065 NASA Glenn Research Center, Cleveland, OH, USA

Intermediate Temperature Fluids Life Tests - Theory

Tarau, Calin; Sarraf, David B.; Locci, Ivan E.; Anderson, William G.; Space Technology and Applications International Forum (STAIF 2007) Proceedings; [2008], pp. 137-146; In English; Space Technology and Applications International Forum (STAIF 2007), Feb. 2007, Albuquerque, NM, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06CA74C; WBS 463169.04.03.04.03; Copyright; Avail.: Other Sources

There are a number of different applications that could use heat pipes or loop heat pipes (LHPs) in the intermediate temperature range of 450 to 750 K, including space nuclear power system radiators, and high temperature electronics cooling. Potential working fluids include organic fluids, elements, and halides, with halides being the least understood, with only a few life tests conducted. Potential envelope materials for halide working fluids include pure aluminum, aluminum alloys, commercially pure (CP) titanium, titanium alloys, and corrosion resistant superalloys. Life tests were conducted with three halides (AlBr₃, SbBr₃, and TiCl₄) and water in three different envelopes: two aluminum alloys (Al-5052, Al-6061) and Cp-2 titanium. The AlBr₃ attacked the grain boundaries in the aluminum envelopes, and formed TiAl compounds in the titanium. The SbBr₃ was incompatible with the only envelope material that it was tested with, Al-6061. TiCl₄ and water were both compatible with CP2-titanium. A theoretical model was developed that uses electromotive force differences to predict the compatibility of halide working fluids with envelope materials. This theory predicts that iron, nickel, and molybdenum are good envelope materials, while aluminum and titanium halides are good working fluids. The model is in good agreement with results from previous life tests, as well as the current life tests.

Author

Heat Pipes; Mathematical Models; Working Fluids; Spacecraft Radiators; Heat Resistant Alloys; Operating Temperature; Metal Halides; Life (Durability)

20080006140 DynaFlow, Inc., Jessup, MD USA

A Numerical Study of Cavitation Inception in Complex Flow Fields

Chahine, Georges L; Hsiao, Chao-Tsung; Choi, Jin-Keun; Dec 2007; 168 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-C-0110

Report No.(s): AD-A475087; 2M4001-1-ONR; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475087>

Prediction of cavitation inception on Navy propulsors is a very challenging task that has preoccupied propulsor designers for many years. This is in fact true for predictions using scaled experimental tests as well as for predictions based on analytical/numerical modeling. Over the past few years very significant progress has been accomplished by the community in terms of both experimental measurements and numerical techniques development and their application to the problem. Novel sophisticated velocity flow field measurement techniques and their efficient practical application to propulsor studies both at Navy research centers and at other Navy funded laboratories has enabled impressive measurements of the complex flow field in details never observed before. These observations quantified mainly the space variations of the flow field using some time and space averaging. Some effort, but so far less impressive, has also illustrated the time unsteady nature of the challenging phenomena. However, additional efforts are necessary but require tremendous capabilities in data storage and analysis to provide us with time fluctuations of pressures. In parallel impressive progress in computational techniques and in computer power has enabled more and more complex and large simulations. These have included Reynolds Averaged Navier Stokes (RANS) simulation, Large Eddy Simulations (LES) and Direct Numerical Simulations (DNS) applied to larger and larger problems.

DTIC

Cavitation Flow; Flow Distribution

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*.

20080002943 Naval Postgraduate School, Monterey, CA USA

Vulnerability Analysis of HD Photo Image Viewer Applications

Juan, Clifford C; Sep 2007; 205 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473936>

The introduction of Microsoft's new graphics file format, Windows Media Photo, into the mainstream market in 2006 has been one of the most interesting developments in the digital world. The file format, which has since been renamed to HD Photo in November of 2006, is being touted as the successor to the ubiquitous JPEG image format, as well as the eventual de facto standard in the digital photography market. With massive efforts already underway to increase the software support of this file format, to make available support for digital camera makers to incorporate it into their products, and to propose the file format to the Joint Photography Experts Group in order to make HD Photo as a standard itself, HD Photo is poised to become as widespread as any of the common image file formats today. This provides the motivation into studying whether the HD Photo file format can be used as a vehicle to compromise a user's system. This work addresses the security of handling the HD Photo file format as it pertains to image viewer applications. Whenever an application is updated to accommodate a new file format, it is possible that the application in question can be vulnerable to exploitation. This is a concern, especially if a malformed instance of that file format can make the application to deviate from its specified behavior and cause the execution of arbitrary code. This thesis investigates if some of the existing applications today that render image files are susceptible to compromise by opening a malformed HD Photo image file. The goal of this thesis is to test the security of various image viewer applications compatible with the HD Photo file format. We modified MiniFuzz, an automated fuzzing tool, to conduct mutation-based smart fuzzing and generation-based fuzzing. The test instrumentation worked correctly, but the test cases did not reveal any security vulnerabilities.

DTIC

High Definition Television; Photographs; Photointerpretation; Vulnerability

20080002953 Naval Postgraduate School, Monterey, CA USA

Identifying Roads and Trains Under Canopy Using Lidar

Owens, Robb E; Espinoza, Fermin; Sep 2007; 128 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473954; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473954>

LIDAR data collected from four geographic regions are studied to determine the feasibility of reliably identifying roads and trails hidden under dense jungle and forest canopies. The four analyzed regions include the Elkhorn Slough in Central California (2005), Kahuku Training Area on the North side of Oahu Island in Hawaii (2005), La Selva Biological Station near Puerto Viejo de Sarapiquí, Costa Rica (1997), and Cougar Mountain Park in Bellevue, Washington (2001). Using the commercial product, Quick Terrain Modeler, 3-D interactive analysis was done to identify roads and trails hidden under canopy. Results are compared to overhead panchromatic imagery and verified by significant ground truth. Trails with widths of 2.5 meters and narrower were found with overall accuracies up to 85%.

DTIC

Canopies (Vegetation); Identifying; Optical Radar; Roads; Trees (Plants); Tropical Regions

20080002960 Florida Univ., Gainesville, FL USA

MIMO Radar - Diversity Means Superiority

Li, Jian; Oct 2007; 41 pp.; In English

Contract(s)/Grant(s): N00014-07-1-0293; Proj-00064512

Report No.(s): AD-A473965; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473965>

We consider a multiple-input multiple-output (MIMO) radar system where both the transmitter and receiver have multiple well-separated subarrays with each subarray containing closely-spaced antennas. Because of this general antenna configuration, both the coherent processing gain and the spatial diversity gain can be simultaneously achieved. We compare

several spatial spectral estimators, including Capon and APES, for target detection and parameter estimation. We introduce a generalized likelihood ratio test (GLRT) and a conditional generalized likelihood ratio test (cGLRT) for the general antenna configuration. Based on GLRT and cGLRT, we then propose an iterative GLRT (iGLRT) procedure for target detection and parameter estimation. Via several numerical examples, we show that iGLRT can provide excellent detection and estimation performance at a low computational cost.

DTIC

Likelihood Ratio; MIMO (Control Systems); Radar

20080003006 Naval Postgraduate School, Monterey, CA USA

HF Over-the-Horizon Radar System Performance Analysis

Liu, Bin-Yi; Sep 2007; 122 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474069>

The basic concept of the structure and properties of the ionosphere are discussed to explain how the performance of the over-the-horizon radar (OTHR) system is affected. An overview of the OTHR system characteristics and performance are presented along with some applications currently used around the world, including their geographic location and historical background. The waveforms used for the OTHR systems include simple pulse, pulse Doppler, phased-coded pulse, frequency modulated continuous wave (FMCW), and frequency modulated interrupt continuous wave (FMICW). Other characteristics such as target detection methods and the skywave OTHR range equation are also discussed. Simulation results indicate that the minimum required input signal-to-noise ratio (SNR) for a target with 100 m² cross section at 3,500 km footprint range is 52.4 f(c) dB at c f = 14.5 MHz. In addition, a noncooperative intercept receiver requires a minimum input SNR of 94 dB for a square law detector and 97 dB for a linear detector for interception at a footprint range of 3,500 km at c f = 14.5 MHz. A model of the maximum detection range for the Chinese FMCW OTH backscatter (OTH-B) radar was developed in MATLAB. An intercept receiver maximum interception range is also analyzed. A ray tracing technique is also used in PROPLAB to present a more detailed analysis. The analysis includes the electron density profile, the maximum usable frequency, the critical frequency of the layers, the skip zone, and the signal quality. The simulations focused on the Chinese OTH-B radar system are to investigate the Chinese surveillance capabilities.

DTIC

Over-the-Horizon Radar; Reliability Analysis

20080003084 Explosives Research and Development Establishment, Waltham Abbey, UK

A High-Speed Rotating Mirror Camera

Whitbread, E G; Sep 1949; 35 pp.; In English

Report No.(s): AD-A474188; ERDE-6/R/49; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Cameras; High Speed; High Speed Cameras; Rotating Mirrors

20080003117 Naval Research Lab., Washington, DC USA

Harmful Algal Blooms in the Mississippi Sound and Mobile Bay: Using MODIS Aqua and In Situ Data for HABs in the Northern Gulf of Mexico

Holiday, Dan; Carter, Gregory; Gould, Richard W; MacIntyre, Hugh; Oct 2007; 5 pp.; In English

Report No.(s): AD-A474275; NRL/PP/7330-07-7181; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study investigates the use of satellite remote sensing to detect blooms and predict environmental conditions leading to the formation of HAVs in the turbid coastal waters along the Mississippi and Alabama shores. Phytoplankton populations and in situ water quality were monitored at 3 to 6 week intervals at 17 locations in Mobile Bay and the Mississippi Sound beginning in July 2005 and continuing thru June 2006 along with concurrent MODIS Aqua weekly composite or same-day imagery. In situ or satellite-derived water properties included surface temperature, salinity, Chla, TSS, CDOM, and nutrient levels. Simple curvilinear and multiple stepwise regressions determined relationships between phytoplankton cell counts and water properties. These results are being used to develop a prediction model for HABs in coastal water of the northern Gulf of Mexico based on daily to weekly satellite observations.

DTIC

Algae; Aqua Spacecraft; Detection; Gulf of Mexico; In Situ Measurement; Phytoplankton; Remote Sensing; Satellite Imagery; Sounds (Topographic Features); Water Quality

20080003149 Naval Postgraduate School, Monterey, CA USA

Personnel Identity Management and the Expeditionary Strike Group

Neises, Glen E; Sep 2007; 91 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474347; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Identity management (IM) plays a critical role in virtually every process involving personnel. 'Identity management' means the ability to uniquely and unambiguously identify people and entities and their interactions and interrelationship, and also the ability to track their mobility in a timely fashion. Currently, Expeditionary Strike Group (ESG) personnel IM suffers from a lack of: technology, systems integration, and training. The purpose of this thesis is to identify best practices and technologies to help resolve ESG personnel IM problems. Chapter I defines IM and explains why IM is important for the Department of Defense (DoD). Chapter II provides an overview of DoD human resource management and Defense Manpower Data Center information systems. Chapter III provides an introduction to the challenges associated with the ESG, personnel IM and information technology (IT). Chapter IV provides an introduction to metrics, Business Process Redesign and Knowledge Value Added. Those concepts are used to derive an answer to the question, 'What does the Non Combatant Evacuation Operation Tracking System do for ESG commanders?' Chapter V summarizes the challenges associated with ESG personnel IM and IT, recommends changes and summarizes the main points of the thesis.

DTIC

Identities; Military Operations; Personnel Management

20080003157 Naval Postgraduate School, Monterey, CA USA

A Smart Climatology of Evaporation Duct Height and Surface Radar Propagation in the Indian Ocean

Twigg, Katherine L; Sep 2007; 159 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474357; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Surface electromagnetic propagation over the ocean is highly sensitive to near-surface atmospheric variability, particularly the height of the evaporation duct. Seasonal variation in near-surface meteorological factors and sea surface temperatures impact the evaporation duct height (EDH). Present U.S. Navy EDH climatology is based on sparse ship observations over a relatively short time period and an outdated evaporation duct (ED) model. This EDH climatology does not utilize smart, or modern, climatology datasets or methods and provides only long term mean (LTM) values of EDH. We have used existing, civilian, dynamically balanced reanalysis data, for 1970 to 2006, and a state-of-the-art ED model, to produce a spatially and temporally refined EDH climatology for the Indian Ocean (IO) and nearby seas. Comparisons of the present U.S. Navy EDH climatology with our climatology show a number of differences. These differences, and the differences in the methods used to generate the two climatologies, indicate that the EDH climatology we have generated provides a more accurate depiction of EDH.

DTIC

Climatology; Ducts; Electromagnetic Wave Transmission; Evaporation; Indian Ocean; Sea Water

20080005220 Army Research Lab., White Sands Missile Range, NM USA

A Preliminary Urban Illumination Model

Shirkey, Richard C; Nov 2007; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474479; ARL-TR-4320; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Army increasingly relies on night operations to accomplish its objectives. These night operations frequently require using night vision goggles and other light-sensitive devices, which are strongly affected by ambient lighting, a large component of which is urban. A preliminary urban illumination model is presented for use in tactical decision aids and wargames, which would allow for more accurate prediction of target acquisition ranges and increased realism in simulations. This initial model predicts broadband brightness as a function of population and distance (>10 km) from the city center under clear and overcast conditions. A technical overview of the model, along with future improvements, is presented.

DTIC

Goggles; Military Operations; Night Vision

20080005321 Army Research Lab., Adelphi, MD USA

Radar Cross Section Measurement of a 50 Caliber Bullet at Ka-Band

Pizzillo, Thomas J; Oct 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474590; ARL-TN-0296; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Static radar cross-section (RCS) measurements of a pristine .50 caliber bullet at Ka-band are reported. Measurements are

from 32.4-GHz to 35.6-GHz using a stepped frequency waveform with range resolution of 4.7-cm. The measurements are compared with model data and have good agreement. The data was collected during the summer of 2003 at the Army Research Laboratory's (ARL) millimeter wave anechoic chamber research facility located at the Adelphi Laboratory Center (ALC), Maryland.

DTIC

Extremely High Frequencies; Radar Cross Sections

20080005632 Colorado State Univ., Fort Collins, CO USA

Microwave Magnetic Materials for Radar and Signal Processing Devices - Thin Film and Bulk Oxides and Metals

Patton, Carl E; Nov 29, 2007; 74 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0889

Report No.(s): AD-A474804; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474804>

ONR Grant N00014-06-1-0889 has supported a program on new magnetic materials in thin film and bulk form for Navy microwave devices and systems in particular and overall defense applications in general. During the funding period from June 4, 2006 to August 3, 2007, there were numerous accomplishments. Seven archival papers were published on (1) ferromagnetic resonance (FMR) measurements in Permalloy films with an emphasis on the comparison of measurement methods, (2) FMR resonance saturation and Suhl instability processes in Permalloy films, (3) low field effective linewidth in polycrystalline ferrites, (4) Fermi-Pasta-Ulam recurrence for spin wave solitons in yttrium iron garnet (YIG) film Strips in a feedback ring system, (5) the Hamiltonian formulation of two magnon scattering microwave relaxation, (6) fundamental properties and structure connections for Fe-Ti-N films, and (7) the detection and analysis of the nonlinear ferromagnetic resonance response in Permalloy films by the magneto-optic Kerr effect.

DTIC

Ferrites; Magnetic Materials; Metals; Microwave Equipment; Microwaves; Military Technology; Oxides; Radar; Signal Processing; Thin Films

20080005840 Naval Research Lab., Washington, DC USA

Analysis of the Naval Observatory Flagstaff Station 1-m Telescope using Annular Zernike Polynomials

Restaino, Sergio R; Teare, Scott W; Divittorio, Michael; Gilbreath, G C; Mozurkewich, David; Jan 2003; 6 pp.; In English
Report No.(s): AD-A474933; NRL-02-1221.1-1519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Naval Observatory Flagstaff Station 1-m telescope is evaluated for the addition of adaptive optics capabilities to its instrumentation suite. Zernike decomposition of the optical system based on phase diversity measurements shows that the static optical aberrations are small enough that they will not degrade the performance of the deformable optical element. The analysis makes use of annular pupil Zernike polynomial reconstruction of the wavefront to accommodate the large obscuration in this telescope and compares this with the results from using filled circular Zernike polynomials.

DTIC

Observatories; Polynomials; Telescopes

20080006078 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Mine Grid Scoring Record No. 838

Fling, Rick; McClung, Christina; Burch, William; McDonnell, Patrick; Teefy, Dennis; Oct 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-8-CO-160-UXO-021

Report No.(s): AD-A474959; ATC-9512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474959>

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Mine Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

Explosives Detection; Portable Equipment; Scoring; Standardization

20080006124 Army Research Lab., Adelphi, MD USA

Numerical Modeling of the Airborne Radar Signature of Dismount Personnel in the UHF-, L-, Ku-, and Ka-Bands

Le, Calvin; Dogaru, Traian; Dec 2007; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475035; ARL-TR-4336; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475035>

This technical report presents numeric computations of the radar cross section (RCS) of a human body placed on top of a ground plane, as seen by an airborne radar. The simulated data was collected in four frequency bands, at low microwave frequencies (UHF- and L-bands), and high microwave frequencies (Ku- and Ka-bands). For the low frequency bands we used the Finite Difference Time Domain (FDTD) modeling technique, whereas for the high frequency bands we employed the Xpatch radar signature software. The results are presented as radar cross section (RCS) over a large range of azimuth and elevation angles. In general, we noticed a relatively small variation of the human body average RCS over a wide range of frequencies, spanning the interval from the UHF- to the Ka-band.

DTIC

Airborne Radar; Electromagnetism; Extremely High Frequencies; Mathematical Models; Personnel; Radar Cross Sections; Radar Signatures; Ultrahigh Frequencies

20080006341 Defence Research and Development Canada, Valcartier, Quebec Canada

Sensor Management for Tactical Surveillance Operations

Benaskeur, A; Irandoust, H; Nov 2007; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475273; DRDC-V-TM-2006-767; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The military typically operates in large-scale, dynamic, and semi-structured environments. A key challenge facing the military operators in these contexts, is to make the most effective use of the available, but scarce, sensors to gather the most complete and relevant information. This defines the sensor management problem that aims at utilizing the sensing resources in a manner that synergistically improves the process of data acquisition and ultimately enhances the perception and the comprehension of the situation of interest. As part of the Command & Control process, sensor management is about the adaptive coordination, allocation, and control of sensing resources. This memorandum provides a state of the art on sensor management in the context of military tactical surveillance operations. In particular, issues and constraints associated with sensor management in scenarios involving a single sensor, multiple sensors aboard a single platform, and multiple sensors distributed across multiple platforms are discussed.

DTIC

Reconnaissance; Surveillance

20080006499 NASA Langley Research Center, Hampton, VA, USA

SAGE III Aerosol Extinction Validation in the Arctic Winter: Comparisons with SAGE II and POAM III

Thomason, L. W.; Poole, L. R.; Randall, C. E.; [2007]; 32 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 23-621-60-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

The use of SAGE III multiwavelength aerosol extinction coefficient measurements to infer PSC type is contingent on the robustness of both the extinction magnitude and its spectral variation. Past validation with SAGE II and other similar measurements has shown that the SAGE III extinction coefficient measurements are reliable though the comparisons have been greatly weighted toward measurements made at mid-latitudes. Some aerosol comparisons made in the Arctic winter as a part of SOLVE II suggested that SAGE III values, particularly at longer wavelengths, are too small with the implication that both the magnitude and the wavelength dependence are not reliable. Comparisons with POAM III have also suggested a similar discrepancy. Herein, we use SAGE II data as a common standard for comparison of SAGE III and POAM III measurements in the Arctic winters of 2002/2003 through 2004/2005. During the winter, SAGE II measurements are made infrequently at the same latitudes as these instruments. We have mitigated this problem through the use potential vorticity as a spatial coordinate and thus greatly increased the number of coincident events. We find that SAGE II and III extinction coefficient measurements show a high degree of compatibility at both 1020 nm and 450 nm except a 10-20% bias at both wavelengths. In addition, the 452 to 1020-nm extinction ratio shows a consistent bias of approx. 30% throughout the lower stratosphere. We also find that SAGE II and POAM III are on average consistent though the comparisons show a much higher variability and larger bias than SAGE II/III comparisons. In addition, we find that the two data sets are not well correlated

below 18 km. Overall, we find both the extinction values and the spectral dependence from SAGE III are robust and we find no evidence of a significant defect within the Arctic vortex.

Author

Aerosols; Arctic Regions; Winter; SAGE Satellite; Polar Regions; Ozone; Clouds (Meteorology); Mathematical Models; Geophysics

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*.

20080002952 California Univ., Berkeley, CA USA

Strong Optical Injection Locking of Edge-Emitting Lasers and Its Applications

Sung, Hyuk-Kee; Aug 18, 2006; 158 pp.; In English

Report No.(s): AD-A473953; UCB/EECS-2006-107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473953>

Semiconductor lasers are essential components that enable high-speed long-haul communication and have been widely used for various applications in photonics technology. Semiconductor lasers under optical injection locking exhibit superior performance over free-running lasers and provide useful applications not achievable through the free-running lasers. The performance of injection-locked lasers has been found to be significantly improved with stronger injection. In this dissertation, the characteristics and applications of semiconductor lasers under strong optical injection locking are presented and analyzed in various aspects. First, ultra-strong (injection ratio $R \sim 10$ dB) optical injection locking properties are investigated experimentally and theoretically. Direct modulation responses of ultra-strong optical injection-locked distributed feedback (DFB) lasers show three distinctive modulation characteristics depending on frequency detuning values. These different optical properties and electric modulation characteristics can be utilized in various applications such as analog fiber optic link, broadband digital communications, RF photonics and opto-electronic oscillators (OEOs). Using the strong injection-locked lasers, a novel sideband generation has been demonstrated. A modulation sideband on the longer wavelength side is enhanced due to the resonant amplification by the slave laser's cavity mode, resulting in a 12-dB asymmetry at 20-GHz RF modulation. The dispersion limited RF bandwidth has been greatly increased by maintaining the variation of fiber transmission response within 7 dB up to 20-GHz RF carrier frequency over 80-km fiber transmission. Second, to improve fiber optic link performances, gain-lever distributed Bragg reflector (DBR) lasers have been fabricated. With a gain-lever modulation, 9-dB increase of a link gain has been achieved compared with a standard modulation.

DTIC

Electro-Optics; Fiber Optics; Injection Locking; Laser Cavities; Lasers; Optical Properties; Pulse Communication; Semiconductor Lasers

20080002966 Air Force Research Lab., Wright-Patterson AFB, OH USA

Unique Femtosecond Micromachining Methods in Semi-Insulating and Conducting Silicon Carbide (Preprint)

Brewer, Chris; Dorsey, Don; Campbell, Angela; Juhl, Shane; DesAutels, G L; Finet, Marc; Ristich, Scott; Whitaker, Matt; Powers, Peter; Zhan, Qiwen; Apr 2007; 13 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A473982; AFRL-ML-WP-TP-2007-496; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473982>

Femtosecond laser pulses were used to write volume phase gratings in bulk 6H semi-insulating and conducting Silicon Carbide (SiC); a wide bandgap semiconductor material provided by Wright-Patterson AFB AFRL/MLPS. Gratings were micro-machined into these materials using a novel anamorphic lens design and an automated x, y, z linear stage to control the sample position. The anamorphic lens reduced the circular laser beam distribution to a 2.5 micron gratings were manufactured for various laser energies, number of laser pulses, and grating line spacing using a direct write process. Single and multi-pulse femtosecond radiations are shown to lead to permanent index of refraction changes from the surface to approximately 10 micrometer below the surface of these bulk materials. Each grating was analyzed visually using a visible microscope and analytically by measuring the diffraction efficiency to determine the most efficient grating. Raman spectroscopy, atomic force

microscopy (AFM), and near field scanning optical microscopy (NSOM) results are also presented.

DTIC

Insulation; Laser Applications; Micromachining; Silicon Carbides

2008002971 Naval Postgraduate School, Monterey, CA USA

Directed-Energy Weapons: Invisible and Invincible?

Deveci, Bayram M; Sep 2007; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473993; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473993>

A military weapon is any tool used to increase the reach or power of a nation. Simply, it can be said that each era witnesses the deployment of new and powerful mass destruction weaponry. What will this century's most powerful weapon be? Directed-energy weapons, which offer advantages over conventional weapons by providing attack at the speed of light, precise targeting, rapid engagement of multiple targets, adjustable damage capacity, low operational cost, reduced logistic support, a nearly unlimited magazine, and wide area coverage for offensive and defensive purposes, seem to be at the forefront of the next revolution in military weapons. This thesis provides an understanding of the principles and techniques of directed-energy weapons. In addition, key directed-energy weapon (DEW) programs in laser weapons and RF directed-energy weapons (high-power microwaves) will be fully described, as well as a providing comparison of these DEW types from a military utility perspective. Last but not least, this study will assist in establishing a vision for how directed-energy weapons could revolutionize military affairs in the Turkish Armed Forces of the future.

DTIC

Laser Weapons; Weapon Systems

2008003002 Army Research Lab., Aberdeen Proving Ground, MD USA

Laser-Based Detection Methods for Explosives

Munson, Chase A; Gottfried, Jennifer L; De Lucia, Jr, Frank C; McNesby, Kevin L; Miziolek, Andrzej W; Sep 2007; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474060; ARL-TR-4279; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474060>

Many well-known explosive detection techniques such as mass spectrometry and chromatography rely on close-contact sampling of surface residues or explosive vapors. Effective detection of explosive materials using laser-based methods has been demonstrated in close-contact and standoff (tens of meters) configurations. This work reviews the current technical progress in laser-based explosive detection methods such as infrared spectroscopy, Raman spectroscopy, terahertz spectroscopy, laser-induced breakdown spectroscopy, and photo fragmentation. The potential for standoff detection using these techniques is also discussed.

DTIC

Explosives; Explosives Detection; Lasers

2008003080 Naval Undersea Warfare Center, Newport, RI USA

Fiber Optic Laser Accelerometer

Maguire, Jason M, Inventor; Nov 6, 2007; 14 pp.; In English

Report No.(s): AD-D020313; No Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/100.2/ADD020313>

An accelerometer is provided for a fiber optic laser. Strain applied to the fiber optic laser results in an emission wavelength shift. The fiber optic laser is joined to a transducer and extends laterally across said transducer. Acceleration of the transducer in a predefined direction causes strain in said fiber optic laser. The transducer can have many possible designs. There is further provided a system for sensing acceleration which includes a pumping laser and a distributor joined to the fiber optic laser. Return signals from the fiber optic laser are provided to an interferometer and analysis circuitry. In the absence of a transducer, the system can operate as a strain sensor.

DTIC

Accelerometers; Fiber Optics; Lasers

20080003114 Naval Observatory, Washington, DC USA

USNO Master Clock Design Enhancements

Koppang, P; Skinner, J; Johns, D; Jan 2007; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474268; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The authors have implemented several enhancements to the U.S. Naval Observatory (USNO) Master Clock system. Design changes to the system include the use of a Kalman filter for phase and frequency estimates, decreasing the time interval between steers, and the redesign of control parameters. The present control system utilizes 'real-time' data estimates of the differences between the Master Clock and a time scale that combines hydrogen masers and commercial cesium frequency standards with a time-varying weighting scheme. They are researching a Master Clock system design that utilizes as its reference a hydrogen maser ensemble that is steered to an ensemble of cesium standards. This paper presents system designs, simulations, and performance data.

DTIC

Atomic Clocks; Augmentation; Clocks; Control; Frequency Standards; Optimization; Time Measurement

20080005257 Northwestern Univ., Evanston, IL USA

Simulation Methods for Rare Events in Nonlinear Lightwave Systems

Kath, William L; May 31, 2007; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0289; Proj-2311/EX

Report No.(s): AD-A474561; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474561>

The objectives of this project were to develop new hybrid analytical/computational methods that are capable of simulating the rare events that are the determining factors of the performance of lightwave systems and devices. These methods use the following: (1) analytical techniques, such as perturbation and asymptotic methods, to guide numerical simulations using importance sampling; and (2) adaptive numerical methods, such as the multicanonical Monte Carlo and cross-entropy methods, to perform the simulation of rare events when guiding analytical models are not available. The above methods can be used to evaluate the performance of specific optical systems and devices, including ultra-high-precision optical clocks based upon mode-locked fiber lasers, and optical clocks and other devices based upon hybrid opto-electronic oscillators. In each case, the goal is to use the methods to develop models that can accurately predict the performance of these devices, as well as determine the failure modes that are the limiting factors in their performance. The author has developed methods based upon soliton perturbation theory and importance sampling to simulate rare events in lightwave systems, including mode-locked laser systems. A key step to using the methods based upon soliton perturbation theory is to use an approximate version of the system dynamics to determine the locations in the large-dimensional state space that most contribute to the desired rare events (e.g., errors). In this method, calculus of variations applied to the approximate system allows the most significant rare events to be located, and then fully detailed importance-sampled Monte-Carlo simulations in the vicinity of these locations properly determines the probabilities of these rare events and corrects for any errors made by the approximations in determining the system dynamics.

DTIC

Electro-Optics; Mathematical Models; Nonlinear Systems; Optical Equipment; Perturbation Theory; Prediction Analysis Techniques; Sampling; Simulation

20080005392 Illinois Univ., Urbana, IL USA

Multi-Disciplinary Research for High Energy Chemical Lasers, Closed-Cycle ElectricOIL Technology

Solomon, Wayne C; Oct 31, 2007; 133 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0357

Report No.(s): AD-A474737; UIUC-AE-05-03; UILU-ENG-05-05-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The program was initiated in July 2002. Work during this grant resulted in more than 50 publications in several major breakthroughs by the MRI team: (1) the first measurement of laser gain in a discharge driven oxygen-iodine system was demonstrated in a supersonic flowing cavity; (2) the first measurement of positive gain in a discharge driven oxygen-iodine system was then demonstrated in a subsonic flow tube; (3) the first continuous wave (cw) discharge driven oxygen-iodine laser was demonstrated; (4) laser gain and power were increased by almost two orders of magnitude; (5) key measurements were made related to ElectricOIL specific kinetics; (6) critical new understanding of the electrodynamic phenomena in a pulse-sustainer type of discharge was attained using a detailed plasma discharge model; and (7) experiments with a

pulse-sustainer discharge concept support the intriguing results from the new electrodynamic models.

DTIC

Chemical Lasers; Chemical Oxygen-Iodine Lasers; Closed Cycles; High Power Lasers; Oils

20080005611 National Taiwan Univ., Taipei, Taiwan, Province of China

A Nanocrystallite Si based Metal-Semiconductor-Metal Photosensors and Solar Energy Transformers with Enhanced Responsivity at UV-blue Wavelengths

Lin, Gong-Ru; Dec 5, 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-01-0065

Report No.(s): AD-A474748; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474748>

Structural damage enhanced near-infrared electroluminescence (EL) of a metal-oxide-semiconductor light emitting diode (MOSLED) made on SiO_x film with buried nanocrystallite Si after CO₂ laser rapid-thermal-annealing (RTA) at an optimized intensity of 6 kW/cm² for 1 ms is demonstrated. CO₂ laser RTA induced oxygen-related defects are capable of improving Fowler-Nordheim tunneling mechanism of carriers at metal/SiO_x interface. The CO₂ laser RTA SiO_x film reduces Fowler-Nordheim tunneling threshold to 1.8 MV/cm, facilitating an enhanced EL power of an ITO/ SiO_x/p-Si/Al MOSLED up to 50 nW at a current density of 2.3 mA/cm²

DTIC

Annealing; Carbon Dioxide Lasers; Color; Electroluminescence; MSM (Semiconductors); Photoelectricity; Radiation Measuring Instruments; Solar Energy; Transformers

20080005620 Purdue Univ., West Lafayette, IN USA

Oscillations in a Forward-Facing Cavity Measured Using Laser-Differential Interferometry in a Hypersonic Quiet Tunnel

Segura, Rodrigo; Dec 11, 2007; 151 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-06-1-0182

Report No.(s): AD-A474770; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474770>

Laminar-turbulent transition is a pivotal factor for the design of hypersonic vehicles but the mechanisms that induce transition are not well understood. A laser differential interferometer (LDI) is a non-intrusive optical device that measures the optical path length difference between two laser beams. The LDI is a reliable calibrated instrument to assist the study of boundary layer instability-wave growth in hypersonic flow and has high sensitivity and frequency response. An LDI with a commercial balanced photodetector capable of detecting optical path length differences of $\lambda/21,000$ from DC to 80 MHz was assembled and tested in the Purdue Quiet-Flow Ludwig tube. Fluctuations in the subsonic region of a forward-facing cavity were measured with the LDI and compared to those detected with a Kulite pressure transducer at the base of the cavity. Predictions of self-resonating deep cavities were confirmed. The LDI was then adapted and transferred to the Boeing/AFOSR Mach-6 Quiet Tunnel.

DTIC

Cavities; Differential Interferometry; Hypersonic Wind Tunnels; Laser Beams; Laser Interferometry; Oscillations; Sensitivity

20080005637 Texas Univ., Austin, TX USA

Advanced Laser Manufacturing of Polymer Nanocomposites

Chen, Shaochen; Dec 7, 2007; 11 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0568

Report No.(s): AD-A474811; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474811>

In this report, we summarized major technical achievements as a result of this ONR YIP grant, including 1) the development of a DMD based micro-stereolithography system for direct-write of CNT nanocomposites, 2) laser micromachining and nanopatterning of nanocomposites, 3) and the development of micro-devices using CNT nanocomposites. We also reported the publications, patents, and people developments supported by this YIP grant.

DTIC

Carbon Fibers; Fiber Composites; Lasers; Manufacturing; Nanocomposites

20080006068 NASA Glenn Research Center, Cleveland, OH, USA

Bench-Top Antigen Detection Technique that Utilizes Nanofiltration and Fluorescent Dyes which Emit and Absorb Light in the Near Infrared

Varaljay-Spence, Vanessa A.; Scardelletti, Maximilian C.; Journal of Laser Applications; Sep. 13, 2007; ISSN 0142-346X; Volume 19, No. 4, pp. 207-213; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 122711.03.04.03.01; Copyright; Avail.: Other Sources

This article discusses the development of a bench-top technique to detect antigens in fluids. The technique involves the use of near infrared NIR fluorescent dyes conjugated to antibodies, centrifugation, nanofilters, and spectrometry. The system used to detect the antigens utilizes a spectrometer, fiber optic cables, NIR laser, and laptop computer thus making it portable and ideally suited for desk top analysis. Using IgM as an antigen and the secondary antibody, anti-IgM conjugated to the near infrared dye, IRDye (trademark) 800, for detection, we show that nanofiltration can efficiently and specifically separate antibody-antigen complexes in solution and that the complexes can be detected by a spectrometer and software using NIR laser excitation at 778 nm and NIR dye offset emission at 804 nm. The peak power detected at 778 nm for the excitation emission and at 804 nm for the offset emission is 879 pW (-60.06 dBm) and 35.7 pW (-74.5 dBm), respectively.

Author

Antigens; Detection; Nanotechnology; Near Infrared Radiation; Dyes; Filtration; Microorganisms; Fluorescence; Electromagnetic Absorption

20080006329 Michigan Univ., Ann Arbor, MI USA

Combinatorial Production and Processing of Oxide Nanopowders for Transparent, Ceramic Lasers

Laine, Richard M; Rand, Stephen C; Jun 2007; 86 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0389

Report No.(s): AD-A475246; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the discovery of transparent polycrystalline alumina by Coble in 1962, transparent and translucent alumina and yttria based ceramics have achieved a significant presence in our everyday lives because of their utility in sodium (and metal halide) vapor lamp envelopes used for example in street lights (automotive lighting). More recently, transparent ceramic scintillators have replaced photographic film in most medical X-ray imaging equipment. Although known for 30 years, transparent ceramic lasers have only recently been shown to offer power outputs superior to single crystal lasers.

DTIC

Aluminum Oxides; Ceramics; Combinatorial Analysis; Lasers; Oxides; Transparence

20080006342 Arizona State Univ., Tempe, AZ USA

Inactivation of Viruses by Coherent Excitations with a Low Power Visible Femtosecond Laser

Tsen, K T; Tsen, Shaw-Wei D; Chang, Chih-Long; Hung, Chien-Fu; Wu, T -C; Kiang, Juliann G; Jun 5, 2007; 6 pp.; In English

Report No.(s): AD-A475274; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Background: Resonant microwave absorption has been proposed in the literature to excite the vibrational states of microorganisms in an attempt to destroy them. But it is extremely difficult to transfer microwave excitation energy to the vibrational energy of microorganisms due to severe absorption of water in this spectral range. We demonstrate for the first time that, by using a visible femtosecond laser, it is effective to inactivate viruses such as bacteriophage M13 through impulsive stimulated Raman scattering. Results and discussion: By using a very low power (as low as 0.5 nJ/pulse) visible femtosecond laser having a wavelength of 425 nm and a pulse width of 100 fs, we show that M13 phages were inactivated when the laser power density was greater than or equal to 50 MW/sq cm. The inactivation of M13 phages was determined by plaque counts and had been found to depend on the pulse width as well as power density of the excitation laser. Conclusion: Our experimental findings lay down the foundation for an innovative new strategy of using a very low power visible femtosecond laser to selectively inactivate viruses and other microorganisms while leaving sensitive materials unharmed by manipulating and controlling with the femtosecond laser system.

DTIC

Activation (Biology); Bacteriophages; Deactivation; Excitation; Laser Mode Locking; Lasers; Viruses

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*.

20080003035 Royal Aircraft Establishment, Farnborough, UK

High Pressure Pumps for Rocket Motors

Barske, U M; Dec 1950; 35 pp.; In English

Report No.(s): AD-A474140; RAE-TN-RPD-40; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474140>

The special requirements which have to be met by rocket motor fuel pumps are described, and a comparative study is made of the suitability of all the important types of pumps for use with rocket motors. A simplified type of open impeller centrifugal pump which has been operated successfully in some short and medium range rockets is recommended as the most suitable type at the present state of development. The theoretical and constructional details of this pump will be given later elsewhere.

DTIC

Fuel Pumps; High Pressure; Pumps; Rocket Engines

20080003817 NASA Glenn Research Center, Cleveland, OH, USA

2006 NASA Seal/Secondary Air System Workshop; Volume 1

Steinetz, Bruce, M., Editor; Hendricks, Robert C., Editor; Delgado, Irebert, Editor; October 2007; 505 pp.; In English; 2006 NASA Seal/Secondary Air System Workshop, 14-15 Nov. 2006, Cleveland, OH, USA; See also 20080003818 - 20080003838; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.13.06

Report No.(s): NASA/CP-2007-214995/VOL1; E-16198-1; Copyright; Avail.: CASI: [A22](#), Hardcopy

The 2006 NASA Seal/Secondary Air System workshop covered the following topics: (i) Overview of NASA's new Exploration Initiative program aimed at exploring the Moon, Mars, and beyond; (ii) Overview of NASA's new fundamental aeronautics technology project; (iii) Overview of NASA Glenn Research Center's seal project aimed at developing advanced seals for NASA's turbomachinery, space, and reentry vehicle needs; (iv) Reviews of NASA prime contractor, vendor, and university advanced sealing concepts including tip clearance control, test results, experimental facilities, and numerical predictions; and (v) Reviews of material development programs relevant to advanced seals development. Turbine engine studies have shown that reducing seal leakages as well as high-pressure turbine (HPT) blade tip clearances will reduce fuel burn, lower emissions, retain exhaust gas temperature margin, and increase range. Several organizations presented development efforts aimed at developing faster clearance control systems and associated technology to meet future engine needs. The workshop also covered several programs NASA is funding to develop technologies for the Exploration Initiative and advanced reusable space vehicle technologies. NASA plans on developing an advanced docking and berthing system that would permit any vehicle to dock to any on-orbit station or vehicle. Seal technical challenges (including space environments, temperature variation, and seal-on-seal operation) as well as plans to develop the necessary 'androgynous' seal technologies were reviewed. Researchers also reviewed seal technologies employed by the Apollo command module that serve as an excellent basis for seals for NASA's new Crew Exploration Vehicle (CEV).

Author

Turbomachinery; Sealing; Aeronautical Engineering; Turbine Engines; Research Facilities; Exhaust Gases; Blade Tips; Turbine Blades

20080003819 Akron Univ., Akron, OH, USA

Some Numerical Simulations and an Experimental Investigation of Finger Seals

Braun, Minel J.; Smith, Ian; Marie, Hazel; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 231-267; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright;

Avail.: CASI: [A03](#), Hardcopy

All seal types have been shown to lift effectively, and experience only minor wear during startup. .. The double pad design outperforms previous seals, providing lower operating temperatures, and less leakage at higher pressures. .. Future

experimentation at higher pressures, temperatures, and operating speeds will show the full potential of finger sealing technology.

Derived from text

Sealing; Wear; Leakage; Operating Temperature

20080003820 Georgia Inst. of Tech., Atlanta, GA, USA

Robustness of Modeling of Out-of-Service Gas Mechanical Face Seal

Green, Itzhak; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 289-323; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Gas lubricated mechanical face seal are ubiquitous in many high performance applications such as compressors and gas turbines. The literature contains various analyses of seals having orderly face patterns (radial taper, waves, spiral grooves, etc.). These are useful for design purposes and for performance predictions. However, seals returning from service (or from testing) inevitably contain wear tracks and warped faces that depart from the aforementioned orderly patterns. Questions then arise as to the heat generated at the interface, leakage rates, axial displacement and tilts, minimum film thickness, contact forces, etc. This work describes an analysis of seals that may inherit any (i.e., random) face pattern. A comprehensive computer code is developed, based upon the Newton- Raphson method, which solves for the equilibrium of the axial force and tilting moments that are generated by asperity contact and fluid film effects. A contact mechanics model is incorporated along with a finite volume method that solves the compressible Reynolds equation. Results are presented for a production seal that has sustained a testing cycle.

Author

Gas Turbines; Compressors; Gas Lubricants; Sealing; Seals (Stoppers); Performance Prediction

20080003821 NASA Glenn Research Center, Cleveland, OH, USA

Overview of LIDS Docking and Berthing System Seals

Daniels, Christopher C.; Dunlap, Patrick H., Jr.; deGroh, Henry C., III; Steinetz, Bruce M.; Oswald, Jay J.; Smith, Ian; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 349-371; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation describes the Low Impact Docking System (LIDS) docking and berthing system seals. The contents include: 1) Description of the Application: Low Impact Docking System (LIDS); 2) LIDS Seal Locations: Vehicle Undocked (Hatch Closed); 3) LIDS Seal Locations: Mechanical Pass Thru; 4) LIDS Seal Locations: Electrical and Pyro Connectors; 5) LIDS Seal Locations: Vehicle Docked (Hatches Open); 6) LIDS Seal Locations: Main Interface Seal; 7) Main Interface Seal Challenges and Specifications; 8) Approach; 9) Seal Concepts Under Development/Evaluation; 10) Elastomer Material Evaluations; 11) Evaluation of Relevant Seal Properties; 12) Medium-Scale (12') Gask-O-Seal Compression Tests; 13) Medium-Scale Compression Results; 14) Adhesion Forces of Elliptical Top Gask-o-seals; 15) Medium-Scale Seals; 16) Medium-Scale Leakage Results: Effect of Configuration; 17) Full Scale LIDS Seal Test Rig Development; 18) Materials International Space Station Experiment (MISSE 6A and 6B); and 19) Schedule.

CASI

General Overviews; International Space Station; Spacecraft Docking; Systems Engineering; Seals (Stoppers)

20080003822 Dayton Univ. Research Inst., OH, USA

A Rapid Survey of the Compatibility of Selected Seal Materials with Conventional and Semi-Synthetic JP-8

Graham, John L.; Striebich, Richard C.; Minus, Donald K.; Harrison, William E., III; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 325-348; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Since the synthesis of a liquid hydrocarbon fuel from coal by Franz Fischer and Hans Tropsch in 1923, there has been cyclic interest in developing this fuel for military and commercial applications. In recent years the U.S. Department of Defense has taken interest in producing a unified battlespace fuel using the Fischer Tropsch (FT) process for a variety of reasons including cost, quality, and logistics. In the past year there has been a particular emphasis on moving quickly to demonstrate that an FT fuel can be used in the form of a blend with conventional petroleum-derived jet fuel. The initial objective is to employ this semi-synthetic fuel with blend ratios as high as 50 percent FT with longer range goals to use even high blend ratios and ultimately a fully synthetic jet fuel. A significant concern associated with the use of a semi-synthetic jet fuel with high FT blend ratios is the effect these low aromatic fuels will have on fuel-wetted polymeric materials, most notably seals and sealants. These materials typically swell and soften to some degree when exposed to jet fuel and the aromatic content of these

fuels contribute to this effect. Semi-synthetic jet fuels with very low aromatic contents may cause seals and sealants to shrink and harden leading to acute or chronic failure. Unfortunately, most of the material qualification tests are more concerned with excessive swelling than shrinkage and there is little guidance offered as to an acceptable level of shrinkage or other changes in physical properties related to low aromatic content. Given the pressing need for guidance data, a program was developed to rapidly survey the volume swell of selected fuel-wetted materials in a range of conventional and semi-synthetic jet fuels and through a statistical analysis to make a determination as to whether there was a basis to be concerned about using fuels with FT blend ratios as high as 50 percent. Concurrent with this analysis data was obtained as to the composition of the fuel absorbed in fuel-wetted materials through the use of GC-MS analysis of swollen samples as well as other supporting data. In this presentation the authors will present a summary of the results of the volume swell and fuel absorbed by selected O-rings and sealants as well as a description of the measurement protocols developed for this program.

Derived from text

Compatibility; Jet Engine Fuels; JP-8 Jet Fuel; Surveys; Synthetic Fuels; O Ring Seals

20080003823 Vibro-Meter, Inc., Atlanta, GA, USA

Microwave Blade Tip Sensor: An Update

Geisheimer, Jon; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 147-169; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Key Technology Features: a) First stage turbine environment (1300 C+ gas path using bleed air cooling); b) 'See through' combustion products, flaming natural gas, steam, etc.; c) Individual measurements from every blade; and d) One size fits all (not limited by 1.5 times diameter).

Author

Blade Tips; Gas Path Analysis; Air Cooling; Combustion Products; Microwaves

20080003824 Ohio Aerospace Inst., Brook Park, OH, USA

Development and Evaluation of High Temperature Gaskets for Hypersonic and Reentry Applications

Singh, Mrityunjay; Shpargel, Tarah; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 443-462; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A wide variety of flexible gasket compositions were developed and tested at high temperatures. The gasket material system has high temperature capability. GRABER sealants were very effective in sealing machined ACC-4 composite surfaces. The gasket composition do not bond strongly with the ACC-4 substrate materials. The density of gasket materials can be tailored to show appropriate compressibility.

Derived from text

Sealers; Compressibility; Gaskets; High Temperature; Joints (Junctions); Sealing

20080003825 Parker-Hannifin Corp., North Haven, CT, USA

High Temperature Metallic Seal/Energizer Development for Aero Propulsion and Gas Turbine Applications

More, Greg; Datta, Amit; Cornett, Ken; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 463-475; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Ultra High Temperature seal program has successfully progressed and developed a high temperature static seal solution. The third prototype has successfully combined the first and second prototypes high performance capabilities in a commercially viable solution. Prototype II and Prototype III are viable solutions: Prototype II offers flexible load tune ability and seating load adjustment and Prototype III offers commercial viability for continuous hoop seals.

Derived from text

Gas Turbine Engines; High Temperature; Loads (Forces); Aircraft Engines; Propulsion

20080003826 Advanced Technologies Group, Inc., Stuart, FL, USA

Force Balance Determination of a Film Riding Seal Using CFD

Justak, John; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 269-288; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

CFD analysis provides a means of discerning H-seal functionality. H-Seal geometry can be modified to provide smaller

or larger operational gap. H-Seal can be installed with large cold clearance and maintain a small operational effective clearance.

Derived from text

Computational Fluid Dynamics; Sealing; Force Distribution

20080003828 NASA Glenn Research Center, Cleveland, OH, USA

Global Energy Issues and Alternate Fueling

Hendricks, Robert C.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 83-107; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation describes world energy issues and alternate fueling effects on aircraft design. The contents include: 1) US Uses about 100 Quad/year (1 Q = 10(exp 15) Btu) World Energy Use: about 433 Q/yr; 2) US Renewable Energy about 6%; 3) Nuclear Could Grow: Has Legacy Problems; 4) Energy Sources Primarily NonRenewable Hydrocarbon; 5) Notes; 6) Alternate Fuels Effect Aircraft Design; 7) Conventional-Biomass Issue - Food or Fuel; 8) Alternate fuels must be environmentally benign; 9) World Carbon (CO₂) Emissions Problem; 10) Jim Hansen s Global Warming Warnings; 11) Gas Hydrates (Clathrates), Solar & Biomass Locations; 12) Global Energy Sector Response; 13) Alternative Renewables; 14) Stratospheric Sulfur Injection Global Cooling Switch; 15) Potential Global Energy Sector Response; and 16) New Sealing and Fluid Flow Challenges.

CASI

Energy Technology; Renewable Energy; Air Pollution; Aircraft Fuels; Energy Consumption; Earth Resources

20080003829 NASA Glenn Research Center, Cleveland, OH, USA

Forming a Turbomachinery Seals Working Group: An Overview and Discussion

Proctor, Margaret P.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 213-230; In English; See also [20080003817](#); Copyright; Avail.: CASI: [A03](#), Hardcopy

Purpose: Identify technical challenges to improving turbomachinery seal leakage and wear performance, reliability and cost effectiveness. Develop a coordinated effort to resolve foundational issues for turbomachinery seal technologies. Identify and foster opportunities for collaboration. Advocate for funding.

Derived from text

Leakage; Turbomachinery; Wear; Reliability

20080003830 NASA Glenn Research Center, Cleveland, OH, USA

Continued Investigation of Leakage and Power Loss Test Results for Competing Turbine Engine Seals

Delgado, Irebert R.; Proctor, Margaret P.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 171-192; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Seal leakage decreases with increasing surface speed due to reduced clearances from disk centrifugal growth. Annular and labyrinth seal leakage are 2-3 times greater than brush and finger seal leakage. Seal leakage rates increase with increasing temperature because of seal clearance growth due to different coefficients of thermal expansion between the seal and test disk. Seal power loss is not strongly affected by inlet temperature. Seal power loss increases with increasing surface speed, seal pressure differential, mass flow rate or flow factor, and radial clearance. The brush and finger seals had nearly the same power loss. Annular and labyrinth seal power loss were higher than finger or brush seal power loss. The brush seal power loss was the lowest and 15-30% lower than annular and labyrinth seal power loss.

Derived from text

Thermal Expansion; Leakage; Inlet Temperature; Centrifugal Force; Brush Seals; Mass Flow Rate; Labyrinth Seals

20080003831 NASA Glenn Research Center, Cleveland, OH, USA

Overview of NASA Glenn Seal Project

Steinetz, Bruce M.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 1-37; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA Glenn hosted the Seals/Secondary Air System Workshop on November 14-15, 2006. At this workshop NASA and our industry and university partners shared their respective seal technology developments. We use these workshops as a technical forum to exchange recent advancements and 'lessons-learned' in advancing seal technology and solving problems of common interest. As in the past we are publishing the presentations from this workshop in two volumes. Volume I will be

publicly available and individual papers will be made available on-line through the web page address listed at the end of this presentation. Volume II will be restricted as Sensitive But Unclassified (SBU) under International Traffic and Arms Regulations (ITAR).

Derived from text

Sealing; Regulations; On-Line Systems

20080003832 NASA Glenn Research Center, Cleveland, OH, USA

High Temperature Investigations into an Active Turbine Blade Tip Clearance Control Concept

Taylor, Shawn; Steinetz, Bruce M.; Oswald, Jay J.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 125-145; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

System studies have shown the benefits of reducing blade tip clearances in modern turbine engines. Minimizing blade tip clearances throughout the engine will contribute materially to meeting NASA's Ultra-Efficient Engine Technology (UEET) turbine engine project goals. NASA GRC is examining two candidate approaches including rub-avoidance and regeneration which are explained in subsequent slides.

Author

Turbine Blades; Turbine Engines; High Temperature; Blade Tips

20080003833 NASA Glenn Research Center, Cleveland, OH, USA

Apollo Seals: A Basis for the Crew Exploration Vehicle Seals

Finkbeiner, Joshua R.; Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; Daniels, Christopher C.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 415-442; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

NASA's Vision for Space Exploration Replace the Space Shuttle for missions to ISS. Return to the Moon. Allow manned exploration of Mars. Apollo-like configuration. Blunt-body heat shield. Conical backshell. CEV requires seal development. Prevent ingestion of reentry gases. Prevent loss of habitable atmosphere.

Derived from text

Heat Shielding; Blunt Bodies; Manned Mars Missions; Space Shuttle Missions; Space Exploration

20080003834 NASA Glenn Research Center, Cleveland, OH, USA

Space Environment's Effects on Seal Materials

deGroh, Henry C., III; Daniels, Christopher C.; Dunlap, Patrick; Miller, Sharon; Dever, Joyce; Waters, Deborah; Steinetz, Bruce M.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 373-395; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

A Low Impact Docking System (LIDS) is being developed by the NASA Johnson Space Center to support future missions of the Crew Exploration Vehicle (CEV). The LIDS is androgynous, such that each system half is identical, thus any two vehicles or modules with LIDS can be coupled. Since each system half is a replica, the main interface seals must seal against each other instead of a conventional flat metal surface. These sealing surfaces are also expected to be exposed to the space environment when vehicles are not docked. The NASA Glenn Research Center (NASA GRC) is supporting this project by developing the main interface seals for the LIDS and determining the durability of candidate seal materials in the space environment. In space, the seals will be exposed to temperatures of between 50 to 50 C, vacuum, atomic oxygen, particle and ultraviolet radiation, and micrometeoroid and orbital debris (MMOD). NASA GRC is presently engaged in determining the effects of these environments on our candidate elastomers. Since silicone rubber is the only class of seal elastomer that functions across the expected temperature range, NASA GRC is focusing on three silicone elastomers: two provided by Parker Hannifin (S0-899-50 and S0-383-70) and one from Esterline Kirckhill (ELA-SA-401). Our results from compression set, elastomer to elastomer adhesion, and seal leakage tests before and after various simulated space exposures will be presented.

Author

Sealing; Elastomers; Adhesion Tests; Durability; Silicone Rubber; Metal Surfaces; Aerospace Environments; Ultraviolet Radiation; Leakage

20080003835 NASA Glenn Research Center, Cleveland, OH, USA

Survey of Dust Issues for Lunar Seals and the RESOLVE Project

Proctor, Margaret P.; Dempsey, Paula J.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007,

pp. 477-494; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Lunar dust poses a challenge to long term missions on the moon. Assessment of material capabilities in the lunar environment is needed. Protecting and/or cleaning sealing surfaces of lunar dust must be addressed for re-usable seals. The RESOLVE project poses a challenging seal problem.

Derived from text

Lunar Dust; Sealing; Surveys; Lunar Environment

20080003836 J and J Technical Solutions, Cleveland, OH, USA

Finite Element Analysis of Elastomeric Seals for LIDS

Oswald, Jay J.; Daniels, Christopher C.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 397-414; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Objective: Create a means of evaluating seals w/o prototypes. Motivation: Cost Prototype 54' seal approx.\$100k per seal pair FEA license + high end workstation approx. \$30k per year. Development time: 6 months lead time for a new seal design Many designs per day (solution time <1 minute) Understanding: Difficult to experimentally measure strains, contact pressure profile, stresses, displacements

Derived from text

Elastomers; Pressure Distribution; Finite Element Method; Displacement

20080003837 NASA Glenn Research Center, Cleveland, OH, USA

Benefits of Improved HP Turbine Active Clearance Control

Ruiz, Rafael; Albers, Bob; Sak, Wojciech; Seitzer, Ken; Steinetz, Bruce M.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 109-123; In English; See also [20080003817](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

As part of the NASA Propulsion 21 program, GE Aircraft Engines was contracted to develop an improved high pressure turbine(HPT) active clearance control (ACC) system. The system is envisioned to minimize blade tip clearances to improve HPT efficiency throughout the engine operation range simultaneously reducing fuel consumption and emissions.

Derived from text

Active Control; High Pressure; NASA Programs; Control Systems Design; Short Haul Aircraft; Systems Engineering; Turbines; Propulsion System Configurations

20080003838 Eaton Aerospace, Warwick, RI, USA

Analysis and Design of a Double-Divert Spiral Groove Seal

Zheng, Xiaoqing; Berard, Gerald; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 193-212; In English; See also [20080003817](#); Copyright; Avail.: CASI: [A03](#), Hardcopy

This viewgraph presentation describes the design and analysis of a double spiral groove seal. The contents include: 1) Double Spiral Design Features; 2) Double Spiral Operational Features; 3) Mating Ring/Rotor Assembly; 4) Seal Ring Assembly; 5) Insert Segment Joints; 6) Rotor Assembly Completed Prototype Parts; 7) Seal Assembly Completed Prototype Parts; 8) Finite Element Analysis; 9) Computational Fluid Dynamics (CFD) Analysis; 10) Restrictive Orifice Design; 11) Orifice CFD Model; 12) Orifice Results; 13) Restrictive Orifice; 14) Seal Face Coning; 15) Permanent Magnet Analysis; 16) Magnetic Repulsive Force; 17) Magnetic Repulsive Test Results; 18) Spin Testing; and 19) Testing and Validation.

CASI

Computational Fluid Dynamics; Grooves; Seals (Stoppers); Spiral Bevel Gears; Mechanical Engineering; Mathematical Models

20080003886 Advanced Cooling Technologies, Inc., Lancaster, PA, USA

Variable Conductance Heat Pipes for Radioisotope Stirling Systems

Anderson, William G.; Tarau, Calin; [2008]; 10 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC07QA40P; WBS 136494.04.01.01; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003886>

In a Stirling radioisotope system, heat must continually be removed from the GPHS modules, to maintain the GPHS modules and surrounding insulation at acceptable temperatures. Normally, the Stirling convertor provides this cooling. If the

Stirling engine stops in the current system, the insulation is designed to spoil, preventing damage to the GPHS, but also ending the mission. An alkali-metal Variable Conductance Heat Pipe (VCHP) was designed to allow multiple stops and restarts of the Stirling engine. A VCHP turns on with a delta T of 30 C, which is high enough to not risk standard ASRG operation but low enough to save most heater head life. This VCHP has a low mass, and low thermal losses for normal operation. In addition to the design, a proof-of-concept NaK VCHP was fabricated and tested. While NaK is normally not used in heat pipes, it has an advantage in that it is liquid at the reservoir operating temperature, while Na or K alone would freeze. The VCHP had two condensers, one simulating the heater head, and the other simulating the radiator. The experiments successfully demonstrated operation with the simulated heater head condenser off and on, while allowing the reservoir temperature to vary over 40 to 120 C, the maximum range expected. In agreement with previous NaK heat pipe tests, the evaporator delta T was roughly 70 C, due to distillation of the NaK in the evaporator.

Author

Conductive Heat Transfer; Heat Pipes; Stirling Engines; Radioisotope Heat Sources; Fabrication

20080005516 NASA Glenn Research Center, Cleveland, OH, USA

2-D and 3-D CFD Modeling of a Microfabricated Segmented-Involute-Foil Regenerator for Stirling Engines

Danila, Daniel; Ibrahim, Mounir B.; Simon, Terrence W.; Gedeon, David; Tew, Roy; [2008]; 47 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS3-03124; WBS 138494.04.01.01; Copyright; Avail.: Other Sources

A microfabricated, segmented-involute-foil regenerator was numerically investigated utilizing the Fluent commercial Computational Fluid Dynamics (CFD) software under both steady- and oscillatory-flow conditions. The geometry consists of a stack of disks with each disk containing segments of involute-shaped micron-range foils and channels located between concentric rings, with channel flow direction perpendicular to the plane of the disk; so the involute-foils are segmented in both axial and radial directions. The lateral orientation of the channels alternates and the concentric rings are offset, from disk to disk in the flow direction; this minimizes surface-area contact between disks. Two-dimensional (2-D) and three-dimensional (3-D) numerical simulations were carried out. Steady-state simulations were performed for Reynolds numbers from 50 up to 2000 based on the channel hydraulic diameter and the mean flow-field velocity. The oscillatory flow conditions were performed for a maximum Reynolds number, $Re_{(sub\ max)}$, of 50 and a Valensi number, $Re_{(sub\ \omega)}$, of 0.229. The results of this CFD research have been validated by comparing the CFD data with data available from the literature. Then the CFD-model results were compared with recent experimental friction-factor and Nusselt-number correlations, obtained at the University of Minnesota from a large-scale mockup of the microfabricated involute foil and from NASA/Sunpower oscillating-flow rig tests of the actual-scale geometry. There was good agreement between these experimental correlations and the CFD data. For the steady-state 3-D simulation, both the local friction factor and the local-mean Nusselt numbers (i.e. mean value from the channel entrance to the local flow direction position) depart from the 2-D simulation values upon entering the second layer. That is where the 3-D effects become obvious and they persist as the axial coordinate advances. At the entrance of every layer, the forced reorientation of the flow results in small rises of both the friction factor and the mean Nusselt number with subsequent decrease as the flow settles into the new layer. Overall the plots of the friction factor and the mean Nusselt number tend to flatten out as the flow reaches a fully developed condition.

Author

Computational Fluid Dynamics; Three Dimensional Models; Stirling Engines; Regenerators; Friction Factor; Nusselt Number; Reynolds Number; Oscillating Flow

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*.

20080003037 Nebraska Univ., Lincoln, NE USA

Process Research and Development of Antibodies as Countermeasures for C. Botulinum

Meagher, Michael; Mar 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0659

Report No.(s): AD-A474155; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474155>

This report describes the design and construction of a CGMP facility for yeast and bacteria on the first floor and basement

of Othmer Hall, the home for the University of Nebraska-Lincoln Biological Process Development Facility. It has taken a significant effort to secure all the required funding and to have final approval by the University of Nebraska Board of Regents to build a fully-funded CGMP facility design. The report describes the final design and initial construction of the facility.
DTIC

Antibodies; Bioassay; Clostridium Botulinum; Construction; Countermeasures; Floors; Laboratories

20080005229 Naval Postgraduate School, Monterey, CA USA

Provincial Reconstruction Teams: Improving Effectiveness

Sellers, Cameron S; Sep 2007; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474498; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Provincial Reconstruction Teams (PRTs) are currently prominent constructs for stabilization and reconstruction in Afghanistan and Iraq. PRTs are composed of civilian-military teams, including elements from coalition partners and the host-nation, and involve multiple military services and civilian agencies. Their missions are to extend the legitimacy of the central government throughout the country and to use Civil Military Operations (CMO) to counter anti-government forces. PRTs are prominent, but controversial. Nongovernmental organizations (NGOs) complain that the U.S. military blurs the lines between humanitarian assistance and military operations. Other critics have called PRTs interagency failures because the U.S. Department of State (DOS), the Department of Defense (DoD), and other government agencies have not contributed the personnel, resources, or training required to make PRTs operationally functional. The result is both lack of integration and of effectiveness. The purpose of this thesis is to determine how to make PRTs more effective in the future. While host-nation participation is necessary for success, this thesis will focus only on the controversies involving NGOs and interagency communities. These include humanitarian space, general attributes, and effectiveness of PRTs. The policy prescription for future PRTs is found in the concept of a Civil Military Operations Center (CMOC), which is described in U.S. Army's FM 3-05.40, 'Civil Affairs Operations.' The core tasks of a CMOC, especially those of Civil Information Management (CIM), are designed to accomplish a variety of missions relating to Post-Conflict Reconstruction (PCR). They would serve well as foundational components of a PRT. Also, because of the interagency nature of PRTs, commanders of these teams must have the right character and skill sets to operate in this complex environment.

DTIC

Construction; Coordination; Organizations; Stability; System Effectiveness; United States

20080005385 Naval Undersea Warfare Center, Newport, RI USA

A Combined Experimental/Analytical Approach to Support the Design of a Lightweight, Rigid-Wall, Mobile Shelter

Cavallaro, Paul V; Jee, Melvin; Nov 5, 2007; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474726; NUWC-NPT-TR-11837; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sandwich panel construction (SPC), which is widely utilized in aircraft design, is particularly advantageous for meeting the stringent structural and weight requirements of lightweight, mobile, military systems. Mobile, rigid-wall shelters must be certified for several transport loading environments, including rail impact (vehicle mounted and dismounted), drop shock, mobility, and external air transport. This technical report documents an investigation into the survivability of an SPC mobile, rigid-wall shelter after it has been exposed to a conventional air blast event. This study used a combined experimental/analytical approach at the material and substructural levels to (1) generate accurate shelter models, (2) validate the material and substructural models, and (3) maximize the shelter's global performance against a conventional air blast event early in the design stage to avoid costly physical tests.

DTIC

Shelters; Walls

20080005612 Monash Univ., Clayton, Australia

Towards 'Zero' False Positive in Structural Health Monitoring

Chiu, Wing K; Chang, F K; Tian, Daniel T; Dec 6, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0080

Report No.(s): AD-A474749; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474749>

Structural Health Monitoring (SHM) is one aspect of a revolution based on the use of Smart Materials and Structures technologies that have the potential to provide major gains in structural performance and cost-efficient life management. We seek to address the issue of information fidelity from ISHM systems (i.e. minimal or no 'false positives') expressed by

representatives from Airbus, Boeing, EADS, US FAA, Lockheed Martin, NASA and USAF at the Panel Discussion at the 5th IWSHM. This work will contribute to the first steps towards the transitioning of current state-of-the-art innovations in SHM to their widespread acceptance in the aerospace industry. This initial work is a concerted study that provides the sound scientific and engineering arguments towards the confidence in information fidelity will constitute a significant leap in the knowledge base of ISHM. The work proposed in this document respond to this challenge and will be the first concerted study towards the provision of these sound scientific and engineering arguments towards the widespread acceptance of ISHM.

DTIC

Crack Propagation; Health; Life (Durability); Stress Waves

20080006284 Naval Research Lab., Washington, DC USA

Fiber Optic Strain Sensors (FOSS) to Monitor Strains on a Navy Vessel During Operations

Nichols, Jonathan M; Seaver, Mark; Trickey, Stephen T; Scandell, Kenneth C; Salvino, Liming; Nov 23, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-07-WX21397

Report No.(s): AD-A475137; NRL/MR/5673--07-9091; XB-NRL/MR/5670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document summarizes the recent deployment of a fiber optic strain sensing (FOSS) system to monitor loads on a Navy Vessel, as requested and authorized by Commander Naval Surface Force, Atlantic. The objectives were to (1) conduct an in-service validation of the technology onboard a U.S. Navy ship and (2) determine contributing influences to recurring cracking of [new] deckplate, as described by the Southeast Regional Maintenance Center (SERMC) Port Engineer. Previous NAVSEA investigations discuss sensitization of the aluminum and onset of stress corrosion cracking (SCC), although the source of the SCC stresses have never been characterized. This effort attempts to quantify performance of the FOSS technology as a tool to provide such characterization. Covered in this document are the instrumentation, data collection and subsequent analysis.

DTIC

Fiber Optics; Navy; Ships

20080006494 NASA Langley Research Center, Hampton, VA, USA

Dynamics of Nanoscale Grain-Boundary Decohesion in Aluminum by Molecular-Dynamics Simulation

Yamakov, V.; Saether, E.; Phillips, D. R.; Glaesegen, E. H.; [2007]; 32 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS1-00135; NCC1-02043; WBS 23-064-20-32; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006494>

The dynamics and energetics of intergranular crack growth along a flat grain boundary in aluminum is studied by a molecular-dynamics simulation model for crack propagation under steady-state conditions. Using the ability of the molecular-dynamics simulation to identify atoms involved in different atomistic mechanisms, it was possible to identify the energy contribution of different processes taking place during crack growth. The energy contributions were divided as: elastic energy, defined as the potential energy of the atoms in fcc crystallographic state; and plastically stored energy, the energy of stacking faults and twin boundaries; grain-boundary and surface energy. In addition, monitoring the amount of heat exchange with the molecular-dynamics thermostat gives the energy dissipated as heat in the system. The energetic analysis indicates that the majority of energy in a fast growing crack is dissipated as heat. This dissipation increases linearly at low speed, and faster than linear at speeds approaching 1/3 the Rayleigh wave speed when the crack tip becomes dynamically unstable producing periodic dislocation bursts until the crack is blunted.

Author

Molecular Dynamics; Simulation; Aluminum; Crack Propagation; Crystal Defects; Grain Boundaries; Potential Energy; Surface Energy; Heat Transfer

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*.

20080003354 National Inst. of Standards and Technology, Boulder, CO USA

Estimating the Receiver Delay for Ionosphere-Free Code (P3) GPS Time Transfer

Zhang, Victor; Jan 1, 2007; 7 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473923; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473923>

The ionosphere-free code (P3) GPS time transfer uses dual-frequency measurements from GPS geodetic receivers to minimize the errors in the ionospheric delay correction. The P3 GPS time transfer requires knowledge of the receiver delays on both the L1 and L2 frequencies (P3 receiver delay). Very few receivers used for P3 GPS time transfer are absolute calibrated, due to the complexity of the calibration. The BIPM has started regular calibration campaigns to determine the delay of the P3 receivers around the world against an absolute calibrated BIPM receiver. This paper presents a method to estimate the P3 receiver delay that uses a calibrated conventional GPS common-view receiver. The uncertainty of the estimated P3 receiver delay is about the same as that obtained by the differential calibration between two P3 receivers. Each timing laboratory with a calibrated common-view receiver can apply this method to estimate the delay of an on-site P3 receiver. This method can also be used to simplify the differential calibration of both the common-view receiver and the P3 receiver with one traveling common view receiver.

DTIC

Atmospheric Models; Earth Ionosphere; Estimating; Global Positioning System; Radio Receivers; Receivers

20080006493 NASA Langley Research Center, Hampton, VA, USA

Trans-Pacific Transport of Saharan Dust to Western North America: A Case Study

Kendry, Ian G. M.; Strawbridge, Kevin B.; O'Neill, Norman; Macdonald, Anne Marie; Liu, Peter S. K.; Leitch, W. Richard; Anlauf, Kurt G.; Jaegle, Lyatt; Fairlie, T. Duncan; Westphal, Douglas L.; [2007]; 41 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 992858.13.07.02; Copyright; Avail.: CASI: [A03](#), Hardcopy

The first documented case of long range transport of Saharan dust over a pathway spanning Asia and the Pacific to Western North America is described. Crustal material generated by North African dust storms during the period 28 February - 3 March 2005 reached western Canada on 13-14 March 2005 and was observed by lidar and sunphotometer in the Vancouver region and by high altitude aerosol instrumentation at Whistler Peak. Global chemical models (GEOS-CHEM and NRL NAAPS) confirm the transport pathway and suggest source attribution was simplified in this case by the distinct, and somewhat unusual, lack of dust activity over Eurasia (Gobi and Takla Makan deserts) at this time. Over western North America, the dust layer, although subsiding close to the boundary layer, did not appear to contribute to boundary layer particulate matter concentrations. Furthermore, sunphotometer observations (and associated inversion products) suggest that the dust layer had only subtle optical impact (Aerosol Optical Thickness (τ_{a500}) and Angstrom exponent ($\alpha_{440-870}$) were 0.1 and 1.2 respectively) and was dominated by fine particulate matter (modes in aerodynamic diameter at 0.3 and 2.5 microns). High Altitude observations at Whistler BC, confirm the crustal origin of the layer (rich in Ca^{++} ions) and the bi-modal size distribution. Although a weak event compared to the Asian Trans-Pacific dust events of 1998 and 2001, this novel case highlights the possibility that Saharan sources may contribute episodically to the aerosol burden in western North America.

Author

Dust Storms; Particulates; Crusts; Photometers; Optical Radar; Aerosols; Optical Thickness

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*.

20060039461

(abstract) Deep Space Network Radiometric Remote Sensing Program

Walter, Steven J.; February 14, 1994; In English; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/36000>

Planetary spacecraft are viewed through a troposphere that absorbs and delays radio signals propagating through it. Tropospheric water, in the form of vapor, cloud liquid, and precipitation, emits radio noise which limits satellite telemetry communication link performance. Even at X-band, rain storms have severely affected several satellite experiments including a planetary encounter. The problem will worsen with DSN implementation of Ka-band because communication link budgets will be dominated by tropospheric conditions. Troposphere-induced propagation delays currently limit VLBI accuracy and are significant sources of error for Doppler tracking. Additionally, the success of radio science programs such as satellite gravity wave experiments and atmospheric occultation experiments depends on minimizing the effect of water vapor-induced propagation delays. In order to overcome limitations imposed by the troposphere, the Deep Space Network has supported a program of radiometric remote sensing. Currently, water vapor radiometers (WVRs) and microwave temperature profilers (MTPs) support many aspects of the Deep Space Network operations and research and development programs. Their capability to sense atmospheric water, microwave sky brightness, and atmospheric temperature is critical to development of Ka-band telemetry systems, communication link models, VLBI, satellite gravity wave experiments, and radio science missions. During 1993, WVRs provided data for propagation mode development, supported planetary missions, and demonstrated advanced tracking capability. Collection of atmospheric statistics is necessary to model and predict performance of Ka-band telemetry links, antenna arrays, and radio science experiments. Since the spectrum of weather variations has power at very long time scales, atmospheric measurements have been requested for periods ranging from one year to a decade at each DSN site. The resulting database would provide reliable statistics on daily, monthly, and seasonal variations. Only long-term monitoring will prevent biases from being introduced by an exceptionally wet or dry year. Support for planetary missions included tropospheric calibration for the recent Mars Observer gravity wave experiments and Ka-band link experiment (KaBLE). Additionally, several proposed radio science experiments such as profiling planetary atmospheres using satellite occultations and Ka-band gravitational wave searches require advanced radiometer technology development. Finally, there has been a consistent advanced technology program to advance satellite navigational and tracking capabilities. This year that included an experiment with radiometer based tropospheric calibration for a series of VLBI catalog measurements.

Author

Annual Variations; Antenna Arrays; Atmospheric Chemistry; Atmospheric Physics; Atmospheric Temperature; Bias; Brightness Temperature; Communication Networks; Deep Space Network; Diurnal Variations; Doppler Radar; Electromagnetic Noise; Errors; Gravitational Waves; Gravity Waves; Mars Observer; Microwave Radiometers; Occultation; Radar Tracking; Radio Signals; Radio Telemetry; Radiometers; Remote Sensing; Satellite Communication; Satellite Tracking; Sky Brightness; Space Missions; Superhigh Frequencies; Telemetry; Temperature Profiles; Troposphere; Very Long Base Interferometry; Water; Water Vapor

20060043971

Spaceborne microwave remote sensing of seasonal freeze-thaw processes in the terrestrial high latitudes : relationships with land-atmosphere CO₂ exchange

McDonald, Kyle C.; Kimball, John S.; Zhao, Maosheng; Njoku, Eni; Zimmermann, Reiner; Running, Steven W.; November 8, 2004; In English; International Society for Optical Engineering (SPIE) International Asia Pacific Environmental Remote Sensing Symposium, November 08, 2004, Honolulu, HI, USA; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/38995>

Landscape transitions between seasonally frozen and thawed conditions occur each year over roughly 50 million square kilometers of Earth's Northern Hemisphere. These relatively abrupt transitions represent the closest analog to a biospheric and hydrologic on/off switch existing in nature, affecting surface meteorological conditions, ecological trace gas dynamics, energy exchange and hydrologic activity profoundly. We utilize time series satellite-borne microwave remote sensing measurements from the Special Sensor Microwave Imager (SSM/I) to examine spatial and temporal variability in seasonal freeze/thaw cycles for the pan-Arctic basin and Alaska. Regional measurements of spring thaw timing are derived using daily brightness

temperature measurements from the 19 GHz, horizontally polarized channel, separately for overpasses with 6 AM and 6 PM equatorial crossing times. Spatial and temporal patterns in regional freeze/thaw dynamics show distinct differences between North America and Eurasia, and boreal forest and Arctic tundra biomes. Annual anomalies in the timing of thawing in spring also correspond closely to seasonal atmospheric CO₂ concentration anomalies derived from NOAA CMDL arctic and subarctic monitoring stations. Classification differences between AM and PM overpass data average approximately 5 days for the region, though both appear to be effective surrogates for monitoring annual growing seasons at high latitudes.

Author

Arctic Ocean; Arctic Regions; Asia; Atmospheric Composition; Biosphere; Brightness Temperature; Carbon Dioxide; Carbon Dioxide Concentration; Ecosystems; Energy Transfer; Europe; Forests; Freezing; Gas Dynamics; Gas Exchange; Melting; Microwave Imagery; North America; Northern Hemisphere; Polar Regions; Remote Sensing; Seasons; Spatial Distribution; Structural Basins; Surface Properties; Temperature Measurement; Temporal Distribution; Terrain; Time Series Analysis; Topography; Trace Contaminants; Trace Elements; Tundra

20080003132 Naval Surface Warfare Center, Bethesda, MD USA

Mask Waves Benchmark

Smith, Timothy C; Hanyok, Lauren K; Hughes, Michael J; Oct 2007; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474307; NSWCCD-50-TR-2007/052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report documents the Maneuvering and Seakeeping Basin wavemaker performance from 2004 to 2007. This report contains benchmark wave cases for comparison with future evaluations of the wavemaker performance. Fifteen data sets were examined for wave amplitude and frequency variability due to spatial position, season, and wavemaker repairs. Wave amplitude variability from wave cycle-to-cycle and between runs was also quantified. Excel macros were developed to aid future comparisons.

DTIC

Masks; Ocean Surface; Structural Basins; Water Waves

20080003170 Naval Postgraduate School, Monterey, CA USA

Effects of Different Camera Motions on the Error in Estimates of Epipolar Geometry between Two Dimensional Images in Order to Provide a Framework for Solutions to Vision Based Simultaneous Localization and Mapping (SLAM)

McVicker, Michael C; Sep 2007; 195 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474386; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis explores the effect camera motion and feature tracking have on the estimations of an epipolar geometry at different stages of a 3D reconstruction and relates the findings to a framework for vision based Simultaneous Localization and Mapping (SLAM). Although there have been previous attempts to determine the quality of algorithms that calculate a fundamental matrix, both robust and linear, we have found no study that explores the relationship between camera motion, or likewise the different types of parallax, and errors in the epipolar geometry between two images as defined by an estimated fundamental matrix. The interest comes from the fact that there are claims to this end made by two prominent textbooks in this area. By using synthetic scenes that are projected with and without noise by camera matrices that define different camera motions between the projections we are able to isolate the three different type of parallax that can be experienced between projections; no parallax shift from rotational movement, a high amount of parallax shift from translational movement in the camera's xy-plane, a high amount of parallax shift from translational movement along the camera's optical axis (z-plane). We also studied an unconstrained movement with components of each of the previous three types. The different camera motions are equivalent to different motions a robot would experience when performing SLAM, specifically, rotational, lateral, forward and unconstrained motions. There are multiple experiments that explore the effect motion has at every stage of a projective reconstruction algorithm.

DTIC

Cameras; Error Analysis; Mapping; Position (Location); Supersonic Low Altitude Missile

20080003199 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA

Standardized UXO Technology Demonstration Site Mine Grid Scoring Record 838

Nov 1, 2007; 40 pp.; In English

Contract(s)/Grant(s): Proj-8-CO-160-UXO-021

Report No.(s): AD-A474440; ATC-9512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded

ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Mine Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Geophysics; Scoring; Standardization

20080003201 Army Test and Evaluation Command, Aberdeen Proving Ground, MD USA
Standardized UXO Technology Demonstration Site Mine Grid Scoring Record 837

Teefy, Dennis; Oct 2007; 41 pp.; In English

Contract(s)/Grant(s): Proj-8-CO-160-UXO-021

Report No.(s): AD-A474442; ATC-9516; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Scoring Record documents the efforts of NAEVA Geophysics, Inc., to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Mine Grid. This Scoring Record was coordinated by Dennis Teefy and the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Command, and the U.S. Army Aberdeen Test Center.

DTIC

Ammunition; Geophysics; Scoring; Standardization

20080003849 NASA Stennis Space Center, Stennis Space Center, MS, USA
Potential of VIIRS Data for Regional Monitoring of Gypsy Moth Defoliation: Implications for Forest Threat Early Warning System

Spruce, Joseph P.; Ryan, Robert E.; Smoot, James C.; Prados, Donald; McKellip, Rodney; Sader, Steven A.; Gasser, Jerry; May, George; Hargrove, William; December 10, 2007; 2 pp.; In English; American Geophysical Union 2007 Winter Meeting, 10-14 Dec. 2007, San Francisco, CA, USA

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0120; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003849>

A NASA RPC (Rapid Prototyping Capability) experiment was conducted to assess the potential of VIIRS (Visible/Infrared Imager/Radiometer Suite) data for monitoring non-native gypsy moth (*Lymantria dispar*) defoliation of forests. This experiment compares defoliation detection products computed from simulated VIIRS and from MODIS (Moderate Resolution Imaging Spectroradiometer) time series products as potential inputs to a forest threat EWS (Early Warning System) being developed for the USFS (USDA Forest Service). Gypsy moth causes extensive defoliation of broadleaved forests in the USA and is specifically identified in the Healthy Forest Restoration Act (HFRA) of 2003. The HFRA mandates development of a national forest threat EWS. This system is being built by the USFS and NASA is aiding integration of needed satellite data products into this system, including MODIS products. This RPC experiment enabled the MODIS follow-on, VIIRS, to be evaluated as a data source for EWS forest monitoring products. The experiment included 1) assessment of MODIS-simulated VIIRS NDVI products, and 2) evaluation of gypsy moth defoliation mapping products from MODIS-simulated VIIRS and from MODIS NDVI time series data. This experiment employed MODIS data collected over the approximately 15 million acre mid-Appalachian Highlands during the annual peak defoliation time frame (approximately June 10 through July 27) during 2000-2006. NASA Stennis Application Research Toolbox software was used to produce MODIS-simulated VIIRS data and NASA Stennis Time Series Product Tool software was employed to process MODIS and MODIS-simulated VIIRS time series data scaled to planetary reflectance. MODIS-simulated VIIRS data was assessed through comparison to Hyperion-simulated VIIRS data using data collected during gypsy moth defoliation. Hyperion-simulated MODIS data showed a high correlation with actual MODIS data (NDVI R2 of 0.877 and RMSE of 0.023). MODIS-simulated VIIRS data for the same date showed moderately high correlation with Hyperion-simulated VIIRS data (NDVI R2 of 0.62 and RMSE of 0.035), even though the datasets were collected about a half an hour apart during changing weather conditions. MODIS products (MOD02, MOD09, and MOD13) and MOD02-simulated VIIRS time series data were used to generate defoliation mapping products based on image classification and image differencing change detection techniques. Accuracy of final defoliation mapping products was assessed by image interpreting over 170 randomly sampled locations found on Landsat and ASTER data in conjunction with defoliation map data from the USFS. The MOD02-simulated VIIRS 400-meter NDVI classification produced a similar overall

accuracy (87.28 percent with 0.72 Kappa) to the MOD02 250-meter NDVI classification (86.71 percent with 0.71 Kappa). In addition, the VIIRS 400-meter NDVI, MOD02 250-meter NDVI, and MOD02 500-meter NDVI showed good user and producer accuracies for the defoliated forest class (70 percent) and acceptable Kappa values (0.66). MOD02 and MOD02-simulated VIIRS data both showed promise as data sources for regional monitoring of forest disturbance due to insect defoliation.

Author

Defoliation; Detection; Forests; Moths; Normalized Difference Vegetation Index; Time Series Analysis; Trees (Plants); Remote Sensing; Change Detection; Plant Stress

20080006328 Army Engineer Research and Development Center, Vicksburg, MS USA

An Evaluation of the Level 1 Natural Resources Inventory Process on Corps Operational Projects

Martin, Chester O; Krause, Jeffrey F; Dec 2007; 11 pp.; In English

Report No.(s): AD-A475243; ERDC-TN-EMRRP-SI-33; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Engineer Regulation (ER) 1130-2-540 (U.S. Army Corps of Engineers (USACE) 2005) mandates that natural resource inventories be conducted on all Corps of Engineers (CE) operational projects. The basic inventory to be conducted at Corps projects was identified by the CE Stewardship Advisory Team (SAT) as the Natural Resources Level I Inventory, described in Krause et al. (2004). In 2005, a study was undertaken as part of the Ecosystem Management and Restoration Research Program (EMRRP) to (1) provide a basic protocol for conducting Level I inventories for Special Status Species, (2) evaluate broad-based inventory methods available for selected taxa, (3) field test and verify components of the Level I Inventory protocol, and (4) develop a methodology for assessing the condition of vegetation types on Corps lands. A protocol for conducting Level I Inventories was completed in 2005 and described in Martin et al. (2006). This technical note provides the results of a preliminary evaluation of the Level I protocol for selected Corps projects.

DTIC

Earth Resources; Engineers; Inventories; Wetlands

20080006498 NASA Langley Research Center, Hampton, VA, USA

Variability in Global Top-of-Atmosphere Shortwave Radiation Between 2000 and 2005

Loebe, Norman G.; Wielicki, Bruce A.; Rose, Fred G.; Doelling, David R.; [2007]; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): WBS 921266.04.07.07; Copyright; Avail.: CASI: [A03](#), Hardcopy

Measurements from various instruments and analysis techniques are used to directly compare changes in Earth-atmosphere shortwave (SW) top-of-atmosphere (TOA) radiation between 2000 and 2005. Included in the comparison are estimates of TOA reflectance variability from published ground-based Earthshine observations and from new satellite-based CERES, MODIS and ISCCP results. The ground-based Earthshine data show an order-of-magnitude more variability in annual mean SW TOA flux than either CERES or ISCCP, while ISCCP and CERES SW TOA flux variability is consistent to 40%. Most of the variability in CERES TOA flux is shown to be dominated by variations global cloud fraction, as observed using coincident CERES and MODIS data. Idealized Earthshine simulations of TOA SW radiation variability for a lunar-based observer show far less variability than the ground-based Earthshine observations, but are still a factor of 4-5 times more variable than global CERES SW TOA flux results. Furthermore, while CERES global albedos exhibit a well-defined seasonal cycle each year, the seasonal cycle in the lunar Earthshine reflectance simulations is highly variable and out-of-phase from one year to the next. Radiative transfer model (RTM) approaches that use imager cloud and aerosol retrievals reproduce most of the change in SW TOA radiation observed in broadband CERES data. However, assumptions used to represent the spectral properties of the atmosphere, clouds, aerosols and surface in the RTM calculations can introduce significant uncertainties in annual mean changes in regional and global SW TOA flux.

Author

Variability; Earth Atmosphere; Solar Radiation; MODIS (Radiometry); Annual Variations; Short Wave Radiation; Climatology; Measuring Instruments

20080006500 NASA Langley Research Center, Hampton, VA, USA

Comparison of Different Global Information Sources Used in Surface Radiative Flux Calculation: Radiative Properties of the Surface

Zhang, Yuanhong; Rossow, William B.; Stackhouse, Paul W., Jr.; [2007]; 67 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 509496.02.01.01.13; Copyright; Avail.: CASI: [A04](#), Hardcopy

Direct estimates of surface radiative fluxes that resolve regional and weather-scale variability over the whole globe with reasonable accuracy have only become possible with the advent of extensive global, mostly satellite, datasets within the past couple of decades. The accuracy of these fluxes, estimated to be about 10-15 W per square meter is largely limited by the accuracy of the input datasets. The leading uncertainties in the surface fluxes are no longer predominantly induced by clouds but are now as much associated with uncertainties in the surface and near-surface atmospheric properties. This study presents a fuller, more quantitative evaluation of the uncertainties for the surface albedo and emissivity and surface skin temperatures by comparing the main available global datasets from the Moderate-Resolution Imaging Spectroradiometer product, the NASA Global Energy and Water Cycle Experiment Surface Radiation Budget project, the European Centre for Medium-Range Weather Forecasts, the National Aeronautics and Space Administration, the National Centers for Environmental Prediction, the International Satellite Cloud Climatology Project (ISCCP), the Laboratoire de Meteorologie Dynamique, NOAA/NASA Pathfinder Advanced Very High Resolution Radiometer project, NOAA Optimum Interpolation Sea Surface Temperature Analysis and the Tropical Rainfall Measuring Mission (TRMM) Microwave Image project. The datasets are, in practice, treated as an ensemble of realizations of the actual climate such that their differences represent an estimate of the uncertainty in their measurements because we do not possess global truth datasets for these quantities. The results are globally representative and may be taken as a generalization of our previous ISCCP-based uncertainty estimates for the input datasets. Surface properties have the primary role in determining the surface upward shortwave (SW) and longwave (LW) flux. From this study, the following conclusions are obtained. Although land surface albedos in the near near-infrared remain poorly constrained (highly uncertain), they do not cause too much error in total surface SW fluxes; the more subtle regional and seasonal variations associated with vegetation and snow are still on doubt. The uncertainty of the broadband black-sky SW albedo for land surface from this study is about 7%, which can easily induce 5-10 W per square meter uncertainty in (upwelling) surface SW flux estimates. Even though available surface (broadband) LW emissivity datasets differ significantly (3%-5% uncertainty), this disagreement is confined to wavelengths greater than 20 micrometers so that there is little practical effect (1-3 W per square meters) on the surface upwelling LW fluxes. The surface skin temperature is one of two leading factors that cause problems with surface LW fluxes. Even though the differences among the various datasets are generally only 2-4 K, this can easily cause 10-15 W per square meter uncertainty in calculated surface (upwelling) LW fluxes. Significant improvements could be obtained for surface LW flux calculations by improving the retrievals of (in order of decreasing importance): (1) surface skin temperature, (2) surface air and near-surface-layer temperature, (3) column precipitable water amount and (4) broadband emissivity. And for surface SW fluxes, improvements could be obtained (excluding improved cloud treatment) by improving the retrievals of (1) aerosols (from our sensitivity studies but not discussed in this work), and (2) surface (black-sky) albedo, of which, NIR part of the spectrum has much larger uncertainty.

Author

Information Systems; MODIS (Radiometry); Radiance; Surface Properties; Clouds (Meteorology); Geophysics; NASA Programs; Climatology

44

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*.

20080005707 Tohoku Gakuin Univ., Sendai, Japan

Comparative Studies of the Performance of High-Speed Gas Bearings for Micro-Turbo Machines

Togo, Shin-ichi; Feb 20, 2006; 53 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA5209-05-P-0234

Report No.(s): AD-A474919; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Developed micromachine gas turbine generator for robotics & man-portable power sources operation at ultra-high speed

(870,000rpm for 10mm compressor). Developed Hydrodynamic Herringbone/Spiral groove bearing to reach design speed and completed test on performance.

DTIC

Gas Bearings; High Speed; Micromechanics

20080005714 Army Research Lab., Adelphi, MD USA

Performance of Carbon/Polytetrafluoroethylene (PTFE) Air Cathodes from pH 0 to 14 for Li-Air Batteries

Marx, Michelle B; Read, Jeffrey A; Dec 2007; 18 pp.; In English

Report No.(s): AD-A474926; ARL-TR-4334; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this project was to construct an inexpensive air cathode free of catalyst that is capable of functioning in both acidic and basic electrolytes. The performance of an uncatalyzed air cathode for use in a Li-Air battery was evaluated over the pH range from 0 to 14. This study was undertaken to determine if air cathodes constructed solely from carbon black and polytetrafluoroethylene (PTFE) can function at a sufficient rate in sulfate based electrolytes to be useful in Li-Air batteries. Layered cathodes were constructed with a hydrophobic wet-proofing layer and an active hydrophilic layer that utilizes a high surface area carbon black. Electrolytes were formulated using H₂SO₄, Na₂SO₄, and NaOH in various combinations giving pH values ranging from 0 to 14. Electrolytes were also formulated using H₂SO₄, Li₂SO₄, and LiOH in combination, and HCl, LiCl, and LiOH in combination giving electrolytes with pH values ranging from 0 to 14. The cathodes were discharged in a three electrode cell from 0.0 V to -0.6 V vs. a Ag/AgCl reference electrode. The cathode performed well and met the requirement that a current density of at least 1-2 mA/cm² was maintained at -0.3 V vs. Ag/AgCl.

DTIC

Carbon; Cathodes; Electric Batteries; Lithium Batteries; pH; Polytetrafluoroethylene

20080005852 Xradia, Inc., Concord, CA USA

X-Ray 3D Metrology System for SOFC Development

Wang, Steve; Oct 2007; 17 pp.; In English

Contract(s)/Grant(s): FA8650-07-M-2706; Proj-0605

Report No.(s): AD-A474854; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Report developed under a SBIR contract. This SBIR project sought to develop an x-ray system for nondestructively imaging the internal three-dimensional structure of solid oxide fuel cells (SOFC) - a CT scanner for fuel cells with sub-50 nm resolution. During the Phase I project, Xradia completed two key tasks that demonstrate the use of this technology in routine SOFC development, specifically for studying Sulfur contamination.

DTIC

Boundaries; Imaging Techniques; Metrology; Solid Oxide Fuel Cells; Sulfur; Systems Engineering; X Rays

20080006127 Industrial Coll. of the Armed Forces, Washington, DC USA

Energy Industry

Butler, James; Bekbenbetov, Marat; Coffman, Katherine; Davies, Kirk; Farrar, Michael R; Fletcher, Scott N; Hall, Robert; Kljajic, Senad; Koprucu, Feza; Leek, Kevin; Jan 2007; 27 pp.; In English

Report No.(s): AD-A475041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475041>

The national well-being of the USA starts with energy security. In an expanding and interrelated global economy it is paramount that the USA develop and execute a national energy policy which is integrated as a key component of the National Security Strategy. This policy must address energy supply stability, support infrastructure improvements, promote greater use of nuclear power, and reduce hazardous emissions through the development of cleaner burning technologies and use of alternative fuels. Specifically, the national energy policy should lead to one air quality standard for automobile emissions, articulate a clear position on reducing greenhouse gas emissions, increase the diversity of fuel supplies through the continued promotion of alternative energies, foster intensive research and development on clean coal energy technologies, expand coal to liquids and coal gasification, expedite the approval process for liquid natural gas terminals, expand integrated natural gas infrastructure, tax nuclear waste to reduce its production, and energize the establishment of the national nuclear waste storage facility at Yucca Mountain. To address these issues, the 2007 Energy Industry Seminar Team traveled domestically to California and internationally to France and the United Arab Emirates to assess and analyze energy producers, distributors,

and regulators. This report details that research and analysis and explains the specific policy recommendations listed above.
DTIC

Energy Conservation; Energy Policy; Industries; Policies; Security; Supplying; United States

20080006325 Library of Congress, Washington, DC USA

Energy Independence and Security Act of 2007: A Summary of Major Provisions

Sissine, Fred; Dec 21, 2007; 28 pp.; In English

Report No.(s): AD-A475228; CRS-RL34294; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Energy Independence and Security Act (P.L. 110-140, H.R. 6) is an omnibus energy policy law that consists mainly of provisions designed to increase energy efficiency and the availability of renewable energy. This report describes the key provisions of the enacted law, summarizes the legislative action on H.R. 6, and provides a summary of the provisions under each of the titles in the law. Many analysts in the CRS Resources, Science, and Industry Division contributed to this report; their names and contact information are located on the back of the summary page.

DTIC

Energy Conservation; Security

20080006458 American Ceramic Society, OH, USA

Ceramics in Energy Applications Overview

Freiman, Stephen, Editor; Cook, Robert, Editor; Coyle, Thomas, Editor; Fischman, Gary, Editor; Hellmann, John, Editor; Green, Martin, Editor; Hobbs, Linn, Editor; Logan, Kathryn, Editor; Sideridis, Costa, Editor; Singh, Mrityunjay, Editor; Smith, Jeffrey, Editor; January 2007; 6 pp.; In English; 1st International Congress on Ceramics, 25-20 Jun. 2006, Toronto, Ontario, Canada

Contract(s)/Grant(s): NNC07ZA02A; WBS 561581.02.08.03.16.02; Copyright; Avail.: Other Sources

The energy applications sessions of the conference incorporated a wide variety of topics related to energy production, distribution, storage, conversion and efficiency. With increasing demand for energy all over the world and limited supply of oil and natural gas, the role of alternative approaches for energy production was emphasized. The potential role of nanotechnology in addressing a number of key material challenges in the energy industry was also discussed in detail. In the alternative power generation arena, the critical role of new ceramic materials and manufacturing technologies in fuel cells, thermoelectrics, and photovoltaics was highlighted. In the area of nuclear power generation, advanced ceramic and glass materials are critical for various components in nuclear reactors as well as in nuclear waste disposal. However, for the wide-scale applications of alternative energy technologies, various issues in terms of performance, reliability and durability have to be addressed along with production and life cycle costs. In the case of fuel cells, fuel processing and hydrogen infrastructure has to be developed. In all types of alternative energy production technologies, extensive field testing of various systems is required. In the energy distribution field, high-temperature superconductors could play a significant role in saving energy less during transmission. Overall, ceramic technologies are poised to play a major role in providing solutions to world energy problems

Author

Ceramics; Energy Technology; Electric Generators

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ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20080002948 Naval Health Research Center, Wright-Patterson AFB, OH USA

Characterization of the Reproductive Toxicity of Depleted Uranium

Still, Kenneth R; Arfsten, Darryl P; Jun 2005; 155 pp.; In English

Contract(s)/Grant(s): DAMD17-02-IA-0003

Report No.(s): AD-A473945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473945>

The purpose of the proposed work is to determine the reproductive and developmental toxicity of depleted uranium (DU) ore in Sprague-Dawley rats. DU-tipped munitions have become common-place on the modern battlefield and recent experience has shown that minor injuries associated with DU munitions are becoming more common. Four hundred ninety-eight adult (P1) SD rats were implanted with up to 20, 1x2mm DU pellets and mated at 30 and 120 days post-implantation. Preliminary

findings indicate no adverse effect associated with DU implantation on P1 reproductive success, or F1 and F2 offspring survival and development.

DTIC

Reproductive Systems; Spent Fuels; Toxicity; Uranium

20080005251 Army Tank-Automotive Command, Warren, MI USA

The U.S. Army, Diesel Engines, and Heavy-Duty Emission Standards

Schihl, Dr Pete; Mar 16, 2007; 25 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474553; TARDEC-17104-RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Briefing discusses the challenges faced in designing propulsion systems for army ground vehicles. Especially problematic is the cooling point for heavy equipment operating in desert conditions and emission standards for heavy duty vehicles.

DTIC

Diesel Engines; Exhaust Emission; Exhaust Gases; Pollution Control; Standards

20080005630 Atomic Energy Commission, New York, NY USA

Radioactive Debris from Operation Castle: Aerial Survey of Open Sea Following Yankee-Nectar

LeVine, Harris D; Graveson, Robert T; Dec 20, 1954; 74 pp.; In English

Report No.(s): AD-A474802; NYO-4618; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474802>

A series of measurements were taken to evaluate the radioactivity in sea water which resulted from bomb debris during the Castle series. The aerial data is correlated with sea water surface and depth activity data to provide an estimate of deposited activity in the measured areas. The technique permits delineation of radioactive areas, will allow early information on direction of heavy fallout paths and will allow more certainty in placement of vessels outside of, or where required, within contaminated sea water areas. This technique also will be useful for civilian defense mapping of contaminated areas on land.

DTIC

Contamination; Nuclear Explosions; Ocean Surface; Radioactivity; Seas; Surveys

20080005700 Library of Congress, Washington, DC USA

Exemptions from Environmental Law for the Department of Defense: An Overview of Congressional Action

Bearden, David M; Jun 2, 2005; 7 pp.; In English

Report No.(s): AD-A474900; CRS-RS22149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several environmental statutes contain national security exemptions, which the Department of Defense (DoD) can obtain on a case-by-case basis. Since FY2003, DoD has sought broader exemptions that it argues are needed to preserve training capabilities and ensure military readiness. There has been disagreement in Congress over the need for broader exemptions in the absence of data on the overall impact of environmental requirements on training and readiness. There also has been disagreement over the extent to which broader exemptions would weaken environmental protection. After considerable debate, the 107th Congress enacted an interim exemption DoD requested from the Migratory Bird Treaty Act, and the 108th Congress enacted a broad exemption from the Marine Mammal Protection Act and a narrower one from certain parts of the Endangered Species Act. These exemptions were contentious to some because of concern about the weakening of protections for animal and plant species. In the 109th Congress, DoD has again requested exemptions from the Clean Air Act, Solid Waste Disposal Act, and Comprehensive Environmental Response, Compensation, and Liability Act. These exemptions have prompted opposition from some states and communities concerned about possible risks to human health from potential exposure to air pollution and hazardous substances. Neither the FY2006 defense authorization bill in the House (H.R. 1815, as passed), nor that in the Senate (S. 1042, as reported), includes these exemptions. This report will be updated as warranted.

DTIC

Defense Program; Education; Environment Protection; Law (Jurisprudence); Maintainability; Requirements; Security

20080005701 Library of Congress, Washington, DC USA

Exemptions from Environmental Law for the Department of Defense: An Overview of Congressional Action

Bearden, David M; May 16, 2005; 7 pp.; In English

Report No.(s): AD-A474901; CRS-RS22149; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Several environmental statutes contain national security exemptions, which the Department of Defense (DoD) can obtain on a case-by-case basis. Since FY2003, DoD has sought broader exemptions that it argues are needed to preserve training

capabilities and ensure military readiness. There has been disagreement in Congress over the need for broader exemptions in the absence of data on the overall impact of environmental requirements on training and readiness. There also has been disagreement over the extent to which broader exemptions would weaken environmental protection. After considerable debate, the 107th Congress enacted an interim exemption DoD requested from the Migratory Bird Treaty Act, and the 108th Congress enacted a broad exemption from the Marine Mammal Protection Act and a narrower one from certain parts of the Endangered Species Act. These exemptions were contentious to some because of concern about the weakening of protections for animal and plant species. In the 109th Congress, DoD has again requested exemptions from the Clean Air Act, Solid Waste Disposal Act, and Comprehensive Environmental Response, Compensation, and Liability Act. These exemptions have prompted opposition from some states and communities that are concerned about possible risks to human health from potential exposure to air pollution and hazardous substances. This report will be updated as relevant developments occur.

DTIC

Defense Program; Education; Environment Protection; Law (Jurisprudence); Maintainability; Requirements; Security

20080006128 California Univ., Livermore, CA USA

Project Buggy Gamma Fallout Field

Clement, III, John P; Gibson, Jr, Thomas A; Mar 11, 1970; 39 pp.; In English

Report No.(s): AD-A475042; UCRL-50832; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475042>

Project Buggy was the first nuclear row cratering detonation executed as part of the Plowshare Program for developing nuclear excavation techniques. Five nuclear explosives, each with a yield of 1.1 kt, were detonated simultaneously at 0904:00.111 PST, 12 March 1968. The explosives were detonated at depths of 135 feet and were spaced 150 feet apart. The experiment took place on Chukar Mesa, Area 30, Nevada Test Site, in a dry, complex basalt formation. The objectives of this phase of the Buggy Event were as follows: (1) to provide ground level gamma fallout field measurements for estimating the total gamma radioactivity vented and deposited in early fallout, (2) to provide fallout field contours from this test event for use in normalizing fallout prediction models, and (3) to determine whether the amount of radioactivity deposited in early fallout from a nuclear row charge is significantly different from that resulting from a single cratering detonation. The gamma radiation early fallout field of the Buggy Event was measured and documented. The radioactive decay of the field with time also was followed. Isoexposure rate contour maps of the fallout field are presented. Analysis of the information collected shows that approximately 3.3% of the gamma-emitting radioactive material produced was deposited beyond the area of continuous ejecta in the fallout field.

DTIC

Carriages; Cratering; Excavation; Fallout; Gamma Rays; Nuclear Explosions; Radiation Measuring Instruments

20080006318 California Univ., Davis, CA USA

Molecular Mechanisms of Nonlinearity in Response to Low Dose Ionizing Radiation

Goldberg, Zelanna; Rocke, David M; Oct 12, 2007; 43 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0132

Report No.(s): AD-A475210; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this very new project we have begun a systematic evaluation of the molecular mechanisms of radiation adaptation. We have developed a wound-healing model that will provide a functional assessment of the promitogenic effects of low dose radiation exposure. We have begun detailed cell cycle analysis of low dose radiation exposure on human keratinocytes and fibroblasts as well as survival as says following priming and challenge doses of ionizing radiation. Initial experiments suggest that doses in the range of 10 cGy provide a promitogenic signal. Further, a priming dose of 10-20 cGy seems to provide radiation protection against subsequent challenge doses up to 4 Gy. Beyond 4 Gy in challenge doses, the radioprotective effect of the priming dose seems to be overwhelmed. Genomic evaluation using the Illumina microarray platform is ongoing.

DTIC

Damage Assessment; Dosage; Ionizing Radiation; Nonlinearity

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*.

20080002925 Montana State Univ., Bozeman, MT USA

Atmospheric Polarization Imaging

Shaw, Joseph A; Nov 1, 2007; 63 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0037

Report No.(s): AD-A473899; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473899>

A full-sky imaging polarimeter has been developed to measure the four Stokes parameters in each pixel of a full-sky image. The Stokes image set can be acquired in typically less than 1 sec., making possible polarimetric measurements in a partly cloudy sky without creating artifacts from moving clouds. This instrument was used to study the variation of atmospheric polarization with cloudiness, finding that the degree of polarization is consistently less in the clear portions of a partly cloudy sky than in a fully clear sky. The instrument also was applied in a validation study of the polarized MODTRAN radiative transfer code. This validation showed that the code generally performs well in conditions of low aerosol optical depth, but the single-scattering model breaks down with higher optical depths. The study shows the need for improved aerosol characterization in future polarization studies, as aerosols have a very large influence on the observed polarization state of visible skylight.

DTIC

Atmospherics; Imaging Techniques

20080002958 Naval Postgraduate School, Monterey, CA USA

Performance of Hybrid Eulerian-Lagrangian Semi-Implicit Time-Integrators for Nonhydrostatic Mesoscale Atmospheric Modeling

De Luca, Thomas J; Sep 2007; 73 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473963; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473963>

In this thesis, the performance and accuracy of explicit, semi-implicit, and Hybrid Eulerian-Lagrangian Semi-Implicit (HELSEI) time-integration methods for use in atmospheric modeling are examined. Four test cases are analyzed: A density current, an inertial gravity wave, a rising thermal bubble, and a hydrostatic mountain wave. Strict attention is paid to computational time, stability criteria, and accuracy. The project aims to show increased efficiency using the HELSEI method over semi implicit methods, which, in turn, should be better than the split-explicit methods currently used in mesoscale models such as WRF, COAMPS, and the German LM model. This increase in efficiency allows for valuable computational resources to be used for other purposes, such as improved data assimilation, increased spatial resolution, or more detailed physics.

DTIC

Atmospheric Models; Hydrostatics; Integrators; Lagrangian Function; Mesometeorology; Mesoscale Phenomena; Mountains; Runge-Kutta Method

20080003044 Naval Postgraduate School, Monterey, CA USA

Sensor Model Requirements for TAWS/IRTSS Operation

Hughes, Rachel; Sep 2007; 123 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474174; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474174>

Possible improvements to the minimum resolvable temperature difference (MRTD) entered into TAWS are considered. FLIR92 is modified to include atmospheric turbulence that depends on height in the atmosphere. Resultant MRTDs are compared to the operational FLIR92 MRTD predictions excluding atmospheric turbulence. The difference in the MRTD is only apparent in the higher frequency regime and is less than 0.05% of the MRTD values for a typical test case. MRTD is calculated by FLIR92 and NVThermIP over desert and marine locations and the resultant MRTDs entered into TAWS to compare maximum detection range. NVThermIP yielded a larger maximum detection range by up to 1.5% over the desert and 2% over water.

DTIC

Atmospheric Circulation; Computer Programs; FLIR Detectors; Infrared Instruments; Temperature Gradients; Turbulence

20080003158 Naval Postgraduate School, Monterey, CA USA

Understanding Recent Variability in the Arctic Sea Ice Cover -- Synthesis of Model Results and Observations

Whelan, John; Sep 2007; 83 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474361; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis provides a continuation of the analysis of the diminishing sea ice trend in the Arctic Ocean by examining results from the NPS 1/12 degree pan-Arctic coupled ice-ocean model. While many previous studies have analyzed changes in ice extent and concentration, this research focuses on ice thickness as it gives a better representation of ice volume variability. The skill of the model is examined by comparing its ice thickness output to actual sea ice thickness data gathered during the last three decades. The model comparison is made against the most recently released collection of Arctic ice draft measurements conducted by U.S. Navy submarines between 1979 and 2000. The NPS model indicates an accelerated thinning trend in Arctic sea ice during the last decade. The validation of model output with submarine upward-looking sonar data supports this result. This lends credence to the postulation that the Arctic is likely to be ice-free during the summer in the near future. The diminishing Arctic sea ice will have significant implications for both the physical and operational environment in which the U.S. Navy currently operates.

DTIC

Annual Variations; Arctic Ocean; Change Detection; Ice; Measurement; Sea Ice; Thickness; Trend Analysis; Variability

20080005628 Dew Consulting, Wellesely, MA USA

Atmospheric Turbulence Aircraft Measurement Data Report and Raw Data Summary: Analysis of 2006 EGRETT Data: 060809

Wroblewski, Donald; Jan 4, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0083

Report No.(s): AD-A474797; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474797>

This report describes a data analysis effort to understand high-altitude turbulence measurements made on an EGRETT aircraft flown in Southern Australia.

DTIC

Atmospheric Turbulence; Clear Air Turbulence; Flow Measurement; High Altitude; Turbulent Flow

20080005629 Polytechnic Univ., Brooklyn, NY USA

Precipitation of Trapped Relativistic Electrons by Amplified Whistler Waves in the Magnetosphere

Kuo, S P; Kou, Steven S; Huynh, James T; Kossey, Paul; Jun 2007; 8 pp.; In English

Contract(s)/Grant(s): Proj-4827

Report No.(s): AD-A474801; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474801>

Numerical study of a loss-cone negative mass instability to amplify whistler waves by energetic electrons in the radiation belts is presented. The results show that a very low intensity whistler wave can be amplified by 50 keV electrons more than 25 dB, consistent with the Siple experimental result [Helliwell et al., J. Geophys. Res. 85, 3360 (1980)]. The dependencies of the amplification factor on the energetic electron density and on the initial wave intensity are evaluated. It is shown that the amplification factor decreases as the initial wave intensity increases. However, this gain can still exceed 15 dB for a 30 dB increase of the initial wave intensity, which is needed for the purpose of precipitating MeV electrons in the radiation belts. We then show that there exists a double resonance situation, by which, as an example, a wave is simultaneously in cyclotron resonance with 50 keV electrons as well as with 1.5 MeV electrons; the wave is first amplified by 50 keV electrons and then precipitates 1.5 MeV electrons. With the aid of the cyclotron resonance, the threshold field for the commencement of chaos in the electron trajectories is reduced considerably from that for a general case. Pitch angle scattering of 1.5 MeV electrons is demonstrated. The results show that a whistler wave with magnetic field amplitude of 0.08% of the background magnetic field can scatter electrons from an initial pitch angle of 86.5 deg. to a pitch angle <50 deg.

DTIC

Electron Density (Concentration); High Energy Electrons; Relativistic Particles; Whistlers

METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20080002959 Air Force Research Lab., Wright-Patterson AFB, OH USA

Diode Laser Diagnostics of High Speed Flows (Postprint)

Williams, Skip; Barone, Dominic; Barhorst, Todd; Jackson, Kevin; Lin, K C; Masterson, Pat; Zhao, Qingchun; Sappey, Andrew D; Oct 2006; 17 pp.; In English

Contract(s)/Grant(s): Proj-2308

Report No.(s): AD-A473964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473964>

This document contains the specific requirements and preliminary results for the Optical Mass Capture (OMC) experiment for the Fundamental REsearch Hypersonic Flight experimentation (FRESH Fx) program. The objective of this effort is to develop and demonstrate in flight a diode-laser-based measurement of engine air mass capture in the inlet or isolator of a hypersonic vehicle over an altitude range of 60,000-90,000 ft with an average Mach number of 7.5 over this range. The concept involves the direct measurement of oxygen concentration via absorption spectroscopy, and gas velocity via the Doppler shift of laser light transiting the flowpath. The deduced density-velocity product in a known flow area yields the mass flow rate.

DTIC

Air Masses; Diagnosis; Diodes; Engines; High Speed; Lasers; Supersonic Combustion

20080003119 Naval Research Lab., Bay Saint Louis, MS USA

Wind Speed Variability over the Marmara Sea

B Kara, Ahmet; Wallcraft, Alan J; Jarosz, Ewa; Bourassa, Mark; Apr 2007; 2 pp.; In English

Report No.(s): AD-A474281; NRL/PP/7320-07-7091; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Between 2000 and 2006, wind speed measurements were collected over the Marmara Sea by the SeaWinds scatterometer on the QuikSCAT satellite at a spatial resolution of 0.25 x 0.25 degrees. Relatively small interannual variability was noted in monthly mean wind speeds. Typically, wind speed during the summer was weaker by approximately 2 m/s than that observed in winter. This remotely sensed wind data set is intended for various air-sea interaction studies and modeling efforts in the region.

DTIC

Annual Variations; Backscattering; Detection; Marine Meteorology; Radar Scanning; Remote Sensing; Seas; Variability; Wind Direction; Wind Velocity

20080003120 Naval Research Lab., Bay Saint Louis, MS USA

Multi-Model Super-Ensemble Ocean Prediction: An Operational Example Using a Kalman Filter in the Adriatic Sea

Rixen, Michel; Book, Jeffery W; Martin, Paul J; Pinardi, Nadia; Oddo, Paolo; Chiggiato, Jacopo; Russo, Nello; Apr 2007; 2 pp.; In English

Report No.(s): AD-A474282; NRL/PP/7330-06-7033; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Multi-model Super-Ensembles (SE) aim at combining optimally different models. A dynamic Kalman Filter version of this technique was applied to a unique set of in-situ data and operational ocean models during the Dynamics of the Adriatic in Real-Time (DART) field experiment. The technique was shown to significantly improve forecasting skills.

DTIC

Acoustic Measurement; Acoustic Velocity; Adriatic Sea; Forecasting; Kalman Filters; Marine Meteorology; Ocean Currents; Oceans; Velocity Distribution

20080003121 Naval Research Lab., Bay Saint Louis, MS USA

Wind Speed Accuracy Near the Coastal Boundaries of the Mediterranean Sea

Kara, Birol; Wallcraft, Alan S; Hurlburt, Harley E; Metzger, E J; Apr 2007; 2 pp.; In English

Report No.(s): AD-A474284; NRL/PP/7320-06-7016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The atmospheric model grid from NWP (Numerical Weather Prediction) products tend to include land values over the ocean in near coastal regions. This is due to improper land-masks of the NWP products, causing serious errors in wind speed

for coastal applications. Possible corrections are introduced to overcome such problems.

DTIC

Air Water Interactions; Coastal Water; Coasts; Correction; Masks; Mediterranean Sea; Seas; Wind Velocity

20080003128 Naval Research Lab., Bay Saint Louis, MS USA

Application of Creeping Sea-Fill Methodology to the Wind Speed over the Caspian Sea

Gunduz, Murat; Kara, Ahmet B; Wallcraft, Alan J; Metzger, E J; Apr 2007; 2 pp.; In English

Report No.(s): AD-A474299; NRL/PP/7320-06-7035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Numerical weather prediction (NWP) products include possible errors near coastal regions. The effects of such errors on near-surface wind speed, which is one of the critical variables for coastal applications, are investigated over the Caspian Sea. For this purpose, a creeping sea-fill methodology developed by Kara, Wallcraft, and Hurlburt was applied to the coarse resolution (1.125 degrees x 1.125 degrees) wind speed data obtained from the European Centre for Medium-Range Weather Forecasts (ECMWF), and the results were compared with the relatively fine resolution (0.25 degrees x 0.25 degrees) satellite-based wind speed data. It is shown that the applied methodology improved the accuracy of the wind speed near the coastal regions.

DTIC

Caspian Sea; Coasts; Creep Properties; Forecasting; Ground Wind; Marine Meteorology; Measurement; Ocean Surface; Seas; Wind Velocity

20080003169 Naval Postgraduate School, Monterey, CA USA

Direct Numerical Simulations of the Diffusive Convection and Assessment of Its Impact on Arctic Climate Change

Prikasky, Ivo J; Sep 2007; 81 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474385; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis focuses on the numerical modeling of the oceanic double-diffusive convection, a mixing process which is driven by the two orders of magnitude difference in diffusivities of heat and salt in seawater. This study explores the diffusive regime of double-diffusion. The aim of the research is to quantify the double-diffusive transport in both smooth gradients and thermohaline staircases, and to develop clear insight into the origin of the staircases and specify conditions for their formation. Based on the numerical process modeling, it is determined that the evolutionary pattern of staircases is controlled by the merging events in which weak interfaces erode and disappear. To illustrate dynamics of these events, a theoretical framework merging theorem has been developed. It is numerically confirmed that the merging theorem predicts the time scale of merging events within the order of magnitude. The computed fluxes from numerical experiments are comparable to the diffusive fluxes inferred from the Beaufort Gyre observations and an order of magnitude greater than the fluxes from earlier laboratory-based experiments. The present analysis suggests that the diffusive fluxes could play an important factor in the Arctic heat budget; hence, future study in this field is recommended.

DTIC

Arctic Regions; Climate; Climate Change; Convection; Diffusion; Diffusivity; Mathematical Models; Stairways; Thermodynamic Properties

20080003173 Naval Postgraduate School, Monterey, CA USA

Relationships Between Global Warming and Tropical Cyclone Activity in the Western North Pacific

Meyer, David W; Sep 2007; 163 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474394; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this work, we investigate the relationships between global warming and tropical cyclone activity in the Western North Pacific (WNP). Our hypothesis is that global warming impacts on TC activity occur through changes in the large scale environmental factors (LSEFs) known to be important in determining the formation and intensity of TCs. The LSEFs on which we focus are: Sea surface temperature (SST) exceeding 26C Weak vertical shear in horizontal winds Large positive absolute vorticity at low levels Mean upward motion High mid-level humidity We separate the data into weekly 5x5 region averages. Using a least squares fit, we identify global warming signals in both the SST and vertical wind shear data across the WNP. These signals vary significantly on a 5x5 scale. Logistic regression was used to determine the LSEFs/TC formation probability relationship. Linear regression was performed to determine the LSEF/ACE relationship. Through the two regression models, we determine that each of the LSEFs is important for both TC formation and ACE. Independent data from that used in the

regression modeling was used to validate the models. Our results support our hypothesis, and indicate that global warming has increased TC numbers and intensities in the WNP via the LSEFs.

DTIC

Cyclones; Global Warming; Greenhouse Effect; Meteorological Parameters; Pacific Ocean; Tropical Storms

20080003194 Army Research Lab., White Sands Missile Range, NM USA

Urban-Small Building Complex Environment: Comparing Stable Patterns from Two Similar Urban Field Studies, Volume AS-1

Vaucher, Gail; Sep 2007; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474434; ARL-TR-4256; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The urban stability cycles are not clearly defined. This technical report investigates the urban stability cycle through the use of statistical and empirical observations. These observations are gleaned from two independent urban data sets acquired around a common building complex. The text includes the general features of the test site and a description of the two data sets: WSMR 2003 Urban Study (W03US) and WSMR 2005 Urban Study (W05US). Earlier research found both rural and urban-city stability cycles in the W03US data, which led to a characterization of stable conditions from the W05US data. The W05US stable patterns are the baseline for the W03US and W05US stable pattern spatial and temporal comparisons reported in this document. An executable Test Plan concludes the text and represents the next step toward characterizing the urban stability patterns and defining the diurnal urban-stability cycles.

DTIC

Buildings; Cities; Field Tests; Stability

20080003527 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: September 2007

September 2007; In English; Copyright; Avail.: Other Sources

This CD-ROM concerning the August 2007 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount

Author

Atmospheric Sounding; Japan; Satellite Observation; Satellite Sounding; Meteorological Parameters

20080005248 Washington Univ., Seattle, WA USA

International Arctic Buoy Program Data Report for 1 January 1992-31 December 1992

Colony, Roger L; Rigor, Ignatius G; Oct 1993; 195 pp.; In English

Contract(s)/Grant(s): NOAA-50-DGNC-2-00128

Report No.(s): AD-A474549; APL-UW-TM29-93; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A network of automatic data buoys for monitoring synoptic-scale fields of pressure, temperature, and ice motion throughout the Arctic Basin was recommended by the U.S. National Academy of Sciences in 1974. Based on the Academy's recommendation, the Arctic Ocean Buoy Program was established by the Polar Science Center, University of Washington, in 1978 to support the Global Weather Experiment. Operations began in early 1979 and the program continued through 1990 with funding from various agencies. In 1991, the Arctic Ocean Buoy Program was superseded by the International Arctic Buoy Program (IABP), although the basic objective remains the same: to establish and maintain a network of drifting buoys in the Arctic Ocean to collect data needed for real-time operations and meteorological and oceanographic research. This report is one in a series of data reports that began in 1979. Data for this report were processed as outlined in the 1986 data report with the exception that the authors have reverted to 3-hourly interpolation of sea-level pressure and air temperature. The average daily temperature was calculated from these eight measurements. The tables give daily data for each buoy identified by its Argos number. The data are interpolated values for location and pressure at 1200 GMT. The value is not given if it is not reliably known. The temperature is averaged over the eight synoptic intervals to eliminate diurnal variation. An asterisk indicates that one or more of the temperatures during this day were not known. The plots show contours of surface pressure at 1200 GMT. The daily displacement of each buoy is indicated by a vector originating from the buoy's current position at the beginning of

each day. Buoy positions and displacements were not plotted when the data did not permit good displacement estimates. Usually the pressure measurements were still reliable at these times and were used to construct the pressure field.

DTIC

Arctic Ocean; Arctic Regions; Atmospheric Pressure; Atmospheric Temperature; Buoys; Motion; Ocean Surface; Sea Ice; Sea Level; Surface Temperature

20080005720 Naval Research Lab., Stennis Space Center, MS USA

Makef22: An ADCIRC Model Fort.22 Input File Creation Tool for Surface Wind and Pressure Forcing

Blain, Cheryl A; Linzell, Robert S; Estrade, Brett; Dec 7, 2007; 44 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474939; NRL/MR/7320--07-9082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The User's Manual for the Makef22 software tool, makef22.pl, contains descriptions of the software, including its functionality and usage. The Makef22 software is a Perl-based program that creates an ADvanced CIRCulation (ADCIRC) Model Surface Wind and Pressure Forcing file (fort.22) using the NWS=2 option. The software was developed for ADCIRC version 45.11. In addition to the creation of fort.22 files, the Makef22 utility also can read and process an existing fort.22 file in order to (1) elongate the record either by adding zero valued records at the beginning of the fort.22 file or by repeating the first time record a specified number of times, and/or (2) ramp a specified portion of the fort.22 records from zero to full-scale values. This utility was designed so that readers for new data sources can easily be developed and incorporated into the Makef22 utility. Surface wind and pressure data sources on rectangular, regular grids at known times are read and interpolated onto an ADCIRC finite element mesh (FEM) at user-specified times. The results can be stored in an ASCII text, ADCIRC model specific, fort.22 forcing file.

DTIC

Atmospheric Models; Computer Programs; Ground Wind; Wind Pressure

20080005811 Puerto Rico Univ., Mayaguez, Puerto Rico

Humidity's Influence on Visible Region Refractive Index Structure Parameter Cn2

Chang, Mark P; Font, Carlos O; Gilbreath, G C; Oh, Eun; May 1, 2007; 8 pp.; In English

Report No.(s): AD-A474824; NRL-06-1226-2273; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the near-infrared and visible bandpasses optical propagation theory conventionally assumes that humidity does not contribute to the effects of atmospheric turbulence on optical beams. While this assumption may be reasonable for dry locations, we demonstrate that there is an unequivocal effect owing to the presence of humidity upon the strength of turbulence parameter, Cn 2, from data collected in the Chesapeake Bay area over 100 m length horizontal propagation paths. We describe and apply a novel technique, Hilbert phase analysis, to the relative humidity, temperature, and Cn 2 data to show the contribution of the relevant climate variable to Cn 2 as a function of time.

DTIC

Humidity; Refractivity

20080006085 Scripps Institution of Oceanography, La Jolla, CA USA

Continuing Support of Cloud Free Line of Sight Determination Including Whole Sky Imaging of Clouds

Shields, Janet E; Karr, Monette E; Burden, Art R; Johnson, Richard W; Hodgkiss, William S; Nov 30, 2007; 60 pp.; In English

Contract(s)/Grant(s): N00014-01-D-0043-0013

Report No.(s): AD-A474969; MPL-TM-496; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474969>

This report describes the work done for the Starfire Optical Range, Kirtland Air Force base, under ONR Contract N00014-01-D-0043 DO #13, between 20 April 2006 and 31 July 2007. This work relates to the Air Force's need to characterize the cloud distribution during day and night, for a variety of applications.

DTIC

Imaging Techniques; Line of Sight

20080006486 NASA Langley Research Center, Hampton, VA, USA

Statistical Analyses of Satellite Cloud Object Data from CERES, Part II, Tropical Convective Cloud Objects During 1998 El Nino and Validation of the Fixed Anvil Temperature Hypothesis

Xu, Kuan-Man; Wong, Takmeng; Wielicki, Bruce a.; Parker, Lindsay; Lin, Bing; Eitzen, Zachary A.; Branson, Mark; [2006]; 49 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NSF ATM-0336762; 23-291-97-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

Characteristics of tropical deep convective cloud objects observed over the tropical Pacific during January-August 1998

are examined using the Tropical Rainfall Measuring Mission/ Clouds and the Earth's Radiant Energy System single scanner footprint (SSF) data. These characteristics include the frequencies of occurrence and statistical distributions of cloud physical properties. Their variations with cloud-object size, sea surface temperature (SST), and satellite precessing cycle are analyzed in detail. A cloud object is defined as a contiguous patch of the Earth composed of satellite footprints within a single dominant cloud-system type. It is found that statistical distributions of cloud physical properties are significantly different among three size categories of cloud objects with equivalent diameters of 100 - 150 km (small), 150 - 300 km (medium), and > 300 km (large), respectively, except for the distributions of ice particle size. The distributions for the larger-size category of cloud objects are more skewed towards high SSTs, high cloud tops, low cloud-top temperature, large ice water path, high cloud optical depth, low outgoing longwave (LW) radiation, and high albedo than the smaller-size category. As SST varied from one satellite precessing cycle to another, the changes in macrophysical properties of cloud objects over the entire tropical Pacific were small for the large-size category of cloud objects, relative to those of the small- and medium-size categories. This result suggests that the fixed anvil temperature hypothesis of Hartmann and Larson may be valid for the large-size category. Combining with the result that a higher percentage of the large-size category of cloud objects occurs during higher SST subperiods, this implies that macrophysical properties of cloud objects would be less sensitive to further warming of the climate. On the other hand, when cloud objects are classified according to SSTs where large-scale dynamics plays important roles, statistical characteristics of cloud microphysical properties, optical depth and albedo are not sensitive to the SST, but those of cloud macrophysical properties are strongly dependent upon the SST. Frequency distributions of vertical velocity from the European Center for Medium-range Weather Forecasts model that is matched to each cloud object are used to interpret some of the findings in this study.

Author

Cloud Physics; Statistical Analysis; TRMM Satellite; Ice Clouds; Forecasting; Clouds (Meteorology); Cloud Height Indicators; Climate

20080006487 NASA Langley Research Center, Hampton, VA, USA

An Intercomparison of Microphysical Retrieval Algorithms for Upper Tropospheric Ice Clouds

Comstock, Jennifer M.; d'Entremont, Robert; DeSlover, Daniel; Mace, Gerald G.; Matrosov, Sergey Y.; McFarlane, Sally A.; Minnis, Patrick; Mitchell, David; Sassen, Kenneth; Shupe, Matthew D.; Turner, David D.; Wang, Zhien; [2006]; 38 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The large horizontal extent, location in the cold upper troposphere, and ice composition make cirrus clouds important modulators of the earth's radiation budget and climate. Cirrus cloud microphysical properties are difficult to measure and model because they are inhomogeneous in nature and their ice crystal size distribution and habit are not well characterized. Accurate retrievals of cloud properties are crucial for improving the representation of cloud scale processes in large-scale models and for accurately predicting the earth's future climate. A number of passive and active remote sensing retrieval algorithms exist for estimating the microphysical properties of upper tropospheric clouds. We believe significant progress has been made in the evolution of these retrieval algorithms in the last decade, however, there is room for improvement. Members of the Atmospheric Radiation measurement program (ARM) Cloud properties Working Group are involved in an intercomparison of optical depth(τ), ice water path, and characteristic particle size in clouds retrieved using ground-based instruments. The goals of this intercomparison are to evaluate the accuracy of state-of-the-art algorithms, quantify the uncertainties, and make recommendations for improvement.

Author

Cloud Physics; Atmospheric Radiation; Remote Sensing; Size Distribution; Radiation Measurement; Ice Clouds; Earth Radiation Budget; Climate; Algorithms

20080006488 NASA Langley Research Center, Hampton, VA, USA

Optically Thin Liquid Water Clouds: Their Importance and Our Challenge

Turner, D. D.; Vogelmann, A. M.; Austin, R. T.; Barnard, J. C.; Cady-Pereira, K.; Chiu, J. C.; Clough, S. A.; Flynn, C.; Khaiyer, M. M.; Liljegren, J.; Johnson, K.; Lin, B.; Long, C.; Marshak, A.; Matrosov, S. Y.; McFarlane, S. A.; Miller, M.; Min, Q.; Minnis, P.; O'Hirok, W.; Wang, Z.; Wiscombe, W.; [2006]; 37 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Many of the clouds important to the Earth's energy balance, from the tropics to the Arctic, are optically thin and contain liquid water. Longwave and shortwave radiative fluxes are very sensitive to small perturbations of the cloud liquid water path (LWP) when the liquid water path is small (i.e., < g/sq m) and, thus, the radiative properties of these clouds must be well understood to capture them correctly in climate models. We review the importance of these thin clouds to the Earth's energy balance, and explain the difficulties in observing them. In particular, because these clouds are optically thin, potentially

mixed-phase, and often (i.e., have large 3-D variability), it is challenging to retrieve their microphysical properties accurately. We describe a retrieval algorithm intercomparison that was conducted to evaluate the issues involved. The intercomparison included eighteen different algorithms to evaluate their retrieved LWP, optical depth, and effective radii. Surprisingly, evaluation of the simplest case, a single-layer overcast cloud, revealed that huge discrepancies exist among the various techniques, even among different algorithms that are in the same general classification. This suggests that, despite considerable advances that have occurred in the field, much more work must be done, and we discuss potential avenues for future work.

Author

Cloud Cover; Optical Thickness; Algorithms; Classifications; Energy Budgets; Water; Balance

20080006490 NASA Langley Research Center, Hampton, VA, USA

A Fast Infrared Radiative Transfer Model for Overlapping Clouds

Niu, Jianguo; Yang, Ping; Huang, Huang-Lung; Davies, James E.; Li, Jun; Baum, Bryan A.; Hu, Yong X.; [2006]; 27 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNG04GL24G; NSF ATM-0239605; Copyright; Avail.: CASI: [A03](#), Hardcopy

A fast infrared radiative transfer model (FIRTM2) appropriate for application to both single-layered and overlapping cloud situations is developed for simulating the outgoing infrared spectral radiance at the top of the atmosphere (TOA). In FIRTM2 a pre-computed library of cloud reflectance and transmittance values is employed to account for one or two cloud layers, whereas the background atmospheric optical thickness due to gaseous absorption can be computed from a clear-sky radiative transfer model. FIRTM2 is applicable to three atmospheric conditions: 1) clear-sky, 2) single-layered ice or water cloud, and 3) two simultaneous cloud layers in a column (e.g., ice cloud overlying water cloud). Moreover, FIRTM2 outputs the derivatives (i.e., Jacobians) of the TOA brightness temperature with respect to cloud optical thickness and effective particle size. Sensitivity analyses have been carried out to assess the performance of FIRTM2 for two spectral regions, namely the longwave (LW) band (587.3 - 1179.5/cm) and the short-to-medium wave (SMW) band (1180.1 - 2228.9/cm). The assessment is carried out in terms of brightness temperature differences (BTD) between FIRTM2 and the well-known discrete ordinates radiative transfer model (DISORT), henceforth referred to as BTD (F-D). The BTD (F-D) values for single-layered clouds are generally less than 0.8 K. For the case of two cloud layers (specifically ice cloud over water cloud), the BTD(F-D) values are also generally less than 0.8 K except for the SMW band for the case of a very high altitude (>15 km) cloud comprised of small ice particles. Note that for clear-sky atmospheres, FIRTM2 reduces to the clear-sky radiative transfer model that is incorporated into FIRTM2, and the errors in this case are essentially those of the clear-sky radiative transfer model.

Author

Radiative Transfer; Infrared Radiation; Cloud Cover; Ice Clouds; Brightness Temperature

20080006491 NASA Langley Research Center, Hampton, VA, USA

Physically-Retrieving Cloud and Thermodynamic Parameters from Ultraspectral IR Measurements

Zhou, Daniel K.; Smith, William L., Sr.; Liu, Xu; Larar, Allen M.; Mango, Stephen A.; Huang, Hung-Lung; [2007]; 33 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 23-291-01-01; Copyright; Avail.: CASI: [A03](#), Hardcopy

A physical inversion scheme has been developed, dealing with cloudy as well as cloud-free radiance observed with ultraspectral infrared sounders, to simultaneously retrieve surface, atmospheric thermodynamic, and cloud microphysical parameters. A fast radiative transfer model, which applies to the clouded atmosphere, is used for atmospheric profile and cloud parameter retrieval. A one-dimensional (1-d) variational multi-variable inversion solution is used to improve an iterative background state defined by an eigenvector-regression-retrieval. The solution is iterated in order to account for non-linearity in the 1-d variational solution. It is shown that relatively accurate temperature and moisture retrievals can be achieved below optically thin clouds. For optically thick clouds, accurate temperature and moisture profiles down to cloud top level are obtained. For both optically thin and thick cloud situations, the cloud top height can be retrieved with relatively high accuracy (i.e., error < 1 km). NPOESS Airborne Sounder Testbed Interferometer (NAST-I) retrievals from the Atlantic-THORPEX Regional Campaign are compared with coincident observations obtained from dropsondes and the nadir-pointing Cloud Physics Lidar (CPL). This work was motivated by the need to obtain solutions for atmospheric soundings from infrared radiances observed for every individual field of view, regardless of cloud cover, from future ultraspectral geostationary satellite sounding instruments, such as the Geosynchronous Imaging Fourier Transform Spectrometer (GIFTS) and the Hyperspectral Environmental Suite (HES). However, this retrieval approach can also be applied to the ultraspectral sounding instruments to fly on Polar satellites, such as the Infrared Atmospheric Sounding Interferometer (IASI) on the European MetOp satellite, the

Cross-track Infrared Sounder (CrIS) on the NPOESS Preparatory Project and the following NPOESS series of satellites.

Author

Cloud Physics; Cloud Height Indicators; Infrared Interferometers; Thermodynamic Properties; Meteorological Parameters; Temperature Profiles; Imaging Spectrometers

20080006492 NASA Langley Research Center, Hampton, VA, USA

The Mixed-Phase Arctic Cloud Experiment (M-PACE)

Verlinde, J.; Harrington, J. Y.; McFarquhar, G. M.; Yannuzzi, V. T.; Avramov, A.; Greenberg, S.; Johnson, N.; Zhang, G.; Poellot, M. R.; Mather, J. H.; Turner, D. D.; Eloranta, E. W.; Zak, B. D.; Prenni, A. J.; Daniel, J. S.; Kok, G. L.; Tobin, D. C.; Holz, R.; Sassen, K.; Spangenberg, D.; Minnis, P.; Tooman, T. P.; Ivey, M. D.; Richardson, S. J.; Bahramann, C. P.; [2007]; 47 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): 921266.04.07.07; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Mixed-Phase Arctic Cloud Experiment (M-PACE) was conducted September 27 through October 22, 2004 on the North Slope of Alaska. The primary objective was to collect a data set suitable to study interactions between microphysics, dynamics and radiative transfer in mixed-phase Arctic clouds. Observations taken during the 1997/1998 Surface Heat and Energy Budget of the Arctic (SHEBA) experiment revealed that Arctic clouds frequently consist of one (or more) liquid layers precipitating ice. M-PACE sought to investigate the physical processes of these clouds utilizing two aircraft (an in situ aircraft to characterize the microphysical properties of the clouds and a remote sensing aircraft to constraint the upwelling radiation) over the Department of Energy's Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) on the North Slope of Alaska. The measurements successfully documented the microphysical structure of Arctic mixed-phase clouds, with multiple in situ profiles collected in both single-layer and multi-layer clouds over two ground-based remote sensing sites. Liquid was found in clouds with temperatures down to -30 C, the coldest cloud top temperature below -40 C sampled by the aircraft. Remote sensing instruments suggest that ice was present in low concentrations, mostly concentrated in precipitation shafts, although there are indications of light ice precipitation present below the optically thick single-layer clouds. The prevalence of liquid down to these low temperatures could potentially be explained by the relatively low measured ice nuclei concentrations.

Author

Arctic Regions; Climate; Clouds (Meteorology); Radiative Transfer; Remote Sensing

20080006497 NASA Langley Research Center, Hampton, VA, USA

Statistical Analyses of Satellite Cloud Object Data from CERES, Part III, Comparison with Cloud-Resolving Model Simulations of Tropical Convective Clouds

Luo, Yali; Xu, Kuan-Man; Wielicki, Bruce A.; Wong, Takmeng; Eitzen, Zachary A.; [2007]; 59 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.04.01.27; Copyright; Avail.: CASI: [A04](#), Hardcopy

The present study evaluates the ability of a cloud-resolving model (CRM) to simulate the physical properties of tropical deep convective cloud objects identified from a Clouds and the Earth's Radiant Energy System (CERES) data product. The emphasis of this study is the comparisons among the small-, medium- and large-size categories of cloud objects observed during March 1998 and between the large-size categories of cloud objects observed during March 1998 (strong El Niño) and March 2000 (weak La Niña). Results from the CRM simulations are analyzed in a way that is consistent with the CERES retrieval algorithm and they are averaged to match the scale of the CERES satellite footprints. Cloud physical properties are analyzed in terms of their summary histograms for each category. It is found that there is a general agreement in the overall shapes of all cloud physical properties between the simulated and observed distributions. Each cloud physical property produced by the CRM also exhibits different degrees of disagreement with observations over different ranges of the property. The simulated cloud tops are generally too high and cloud top temperatures are too low except for the large-size category of March 1998. The probability densities of the simulated top-of-the-atmosphere (TOA) albedos for all four categories are underestimated for high albedos, while those of cloud optical depth are overestimated at its lowest bin. These disagreements are mainly related to uncertainties in the cloud microphysics parameterization and inputs such as cloud ice effective size to the radiation calculation. Summary histograms of cloud optical depth and TOA albedo from the CRM simulations of the large-size category of cloud objects do not differ significantly between the March 1998 and 2000 periods, consistent with the CERES observations. However, the CRM is unable to reproduce the significant differences in the observed cloud top height while it overestimates the differences in the observed outgoing longwave radiation and cloud top temperature between the two periods. Comparisons between the CRM results and the observations for most parameters in March 1998 consistently show that both the simulations and observations have larger differences between the large- and small-size categories than between

the large- and medium-size, or between the medium- and small-size categories. However, the simulated cloud properties do not change as much with size as observed. These disagreements are likely related to the spatial averaging of the forcing data and the mismatch in time and in space between the numerical weather prediction model from which the forcing data are produced and the CERES observed cloud systems.

Author

Cloud Physics; Clouds (Meteorology); Statistical Analysis; Histograms; Numerical Weather Forecasting; Atmospheric Models; Radiant Flux Density; Convection

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*.

20080002926 Mayo Clinic, Rochester, MN USA

Aurora-A as a Modifier of Breast Cancer Risk in BRCA 1/2 Mutation Carriers

Couch, Fergus J; Jun 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0588

Report No.(s): AD-A473900; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473900>

The AURORA-A/BTAK/STK15 gene encodes a centrosome-associated kinase that causes centrosome amplification failure of cytokinesis and aneuploidy when amplified and/or overexpressed in breast tumors. A number of gene association studies using matching breast cancer cases and controls have shown that the F31 I polymorphism in STKi 5 increases risk of breast. We hypothesized that the F31I polymorphism is associated with increased risk of breast cancer in BRCA1 and BRCA2 mutation carriers. Using over 7,000 carriers of BRCA1 and BRCA2 deleterious mutations with a mean age of breast cancer diagnosis of 42 years we have shown that F31I has no influence on breast cancer risk. In parallel we have completed an association study of 2400 polymorphisms in other cell division regulatory genes in 800 breast cancer cases and 800 controls collected at the Mayo Clinic. A total of 144 polymorphisms displayed significant associations with breast cancer risk. An effort to validate these findings in 4000 BRCA1 and BRCA2 mutation carriers from six collaborating groups has been initiated but this is not yet complete.

DTIC

Auroras; Breast; Cancer; Genetics; Mammary Glands; Mutations; Risk

20080002937 Walter Reed Army Inst. of Research, Silver Spring, MD USA

Rheoencephalogram Reflects Cerebral Blood Flow Autoregulation in Pigs

Bodo, Michael; Pearce, Frederick; Van Albert, Stephen; Armonda, Rocco; Jan 2007; 6 pp.; In English

Report No.(s): AD-A473927; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473927>

The objective of the present study was to compare systemic arterial pressure (SAP), rheoencephalogram (REG), and carotid flow (CF) measured by Doppler ultrasound. Twenty-eight anesthetized Yorkshire pigs were measured to evaluate Cerebral Blood Flow (CBF) Autoregulation (AR) during several CBF manipulations: hemorrhage, positive end-expiratory pressure (PEEP), and transitory SAP decrease and increase. Data were sampled with 200 Hz and processed off-line. 1) Hemorrhage elicited a decrease in SAP and transitory increases in REG and CF amplitude; 2) PEEP resulted in a decrease in SAP and increases in REG and CF amplitude; 3) PEEP after hemorrhage caused decreases in SAP, REG and CF amplitudes. When CBF AR was present, it was detected by both REG and carotid flow. Following hemorrhage, CBF AR was lost; CF and REG passively followed SAP. The clinical importance of these findings is that REG can be measured more conveniently and continuously in humans than can Doppler ultrasound. Therefore, measurement of CBF autoregulation by REG has potential for use as a life sign monitoring modality.

DTIC

Arteries; Automatic Control; Blood Circulation; Blood Flow; Brain Circulation

20080002941 Naval Health Research Center, Wright-Patterson AFB, OH USA

Neurobehavioral Effects of Sodium Tungstate Exposure on Rats and Their Progeny

McInturf, S M; Bekkedal, M Y; Olabisi, A; Arfsten, D; Wilfong, E; Casavant, R; Jederberg, W; Gunasekar, P G; Chapman, G; Jun 30, 2007; 25 pp.; In English

Report No.(s): AD-A473933; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473933>

In the mid 1990's, the use of tungsten as a replacement for lead and depleted uranium began for the manufacture of small arms munitions and armor penetrator munitions, respectively. Recent reports have demonstrated that tungsten can solubilize in soil and is present in some US drinking water supplies, however, little research has been conducted to determine the human health consequences of exposure. The purpose of this study was to use a battery of tests as an initial screen for potential neurobehavioral effects that may be associated with 70 days of daily tungsten exposure via drinking water. Sprague-Dawley rats were orally dosed with diH₂O vehicle, 5 or 125 mg/kg/day of sodium tungstate for 70 consecutive days. The rats were mated after 14 days and dosing continued through pregnancy up to post-natal day 21. Following sodium tungstate treatment, neurobehavioral tests were conducted on the adult females and their pups. Early neurobehavioral evaluations on the-pups were done through tests of the righting reflex and maternal separation distress as measured by ultrasonic vocalizations. The adult females were tested for maternal retrieval, acoustic startle/pre-pulse inhibition (AS/PPI), spontaneous locomotor activity, and navigation in a watermaze. In the pups, a 78% increase in distress. - vocalizations was observed in the highest dose group as compared to controls and an interaction of sex and dose was found for righting reflex latencies. While there were no treatment related effects for maternal retrieval, AS/PPI or watermaze navigation, dose related effects were observed for measures of locomotor activity. Adult females treated with the low dose showed increased distance traveled, more time in ambulatory movements, and less time in stereotypic behavior than controls or high dose animals. Those receiving the highest dose had more time in stereotypical movements than controls, and less time resting than controls and the lowest exposure group.

DTIC

Exposure; Information Retrieval; Neurophysiology; Progeny; Rats; Sodium; Tungstates

20080002980 Wisconsin Univ., Madison, WI USA

Development of Micro-Scale Assays of Mammary Stem and Progenitor Cells

Paguirigan, Amy L; Jul 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0487

Report No.(s): AD-A474019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474019>

The main focus of this work is to study the effects of population demographics in the mammary gland on cancer risk using mathematical means and employ microtechnology for in vitro studies of primary cell characteristics. Specific attention has been paid to developing more quantitative methods for analyzing microfluidic cell cultures using In Channel Westerns. Also understanding how the microfluidic culture platform differs from traditional macro-scale techniques is critical. By thoroughly understanding how this culture platform affects the cellular baseline first better and more efficient data collection can be performed thus requiring fewer primary cells. Preliminary results showing the effectiveness and ease of using In Channel Western protocols for studying protein expression in microfluidic cultures is promising.

DTIC

Assaying; Breast; Cancer; Mammary Glands; Proteins; Stem Cells

20080002998 TRICARE Southwest, San Antonio, TX USA

Affects of Provider Type on Patient Satisfaction, Productivity and Cost Efficiency

Foster, Timothy; Apr 25, 2006; 66 pp.; In English

Report No.(s): AD-A474053; AMDCS-35-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474053>

The purpose of this one year retrospective quantitative study is to determine if the type of provider (physician, nurse practitioner, and physician assistant) influences patient satisfaction and productivity. 104,013 Army beneficiaries who visited their Primary Care Managers (PCM) from January 2004 to December 2004, were surveyed and their results were used as the sample for this study. Provider productivity and cost efficiency within CONUS Military Treatment Facilities (MTFs) was evaluated using the period of January 2004 to December 2004, with a sample size of 20,421. The alpha level was set at .05 and multiple linear regression and analysis of variance were used to determine the predictive value of the model. The results show that there is a statistically significant positive relationship between nurse practitioners and patient satisfaction. The

analysis of variance showed that physician assistants have a lower cost per visit ratio, and there is no difference between provider types and relative value units.

DTIC

Cost Effectiveness; Patients; Personnel; Physicians; Productivity

20080003015 Naval Postgraduate School, Monterey, CA USA

Multi Attribute Decision Analysis in Public Health - Analyzing Effectiveness of Alternate Modes of Dispensing

Sep 2007; 141 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474082; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474082>

Local emergency planners are creating mass prophylaxis plans to prophylax entire populations within forty eight hours in order to reduce mortality after a bioterrorist attack. The Points of Dispensing (PODs) used in prophylaxis are central to an area's mass prophylaxis plans, but they are insufficient because of their staffing and security constraints. Several alternate modes of dispensing that have similar attributes and are considered best practices are presently being implemented in local health departments (LHDs). The purpose of this thesis is to develop models to evaluate alternate modes of dispensing using multi-attribute value function (MAVF), an approach that supports multi-attribute decision-making by taking into account the trade-offs a decision-maker is willing to make between attributes. Two models are created for Los Angeles County (LAC). The models showed that in LAC, the door-to-door option, pharmacy option, civil service option and Kaiser Permanente option work best. The study finds that alternate modes of dispensing can be useful in filling the gaps in the POD-based approach by increasing critical resources or lowering the pressure on existing resources.

DTIC

Decision Making; Decision Theory; Dispensers; Medical Services; Public Health

20080003016 Maryland Univ., Baltimore, MD USA

Airport, Academia, Industry, Military, State (AAIMS) Consortium to Test Military/Civilian Communications and FDDMTF Deployment for OCONUS Mass Casualties

Mackenzie, Colin; Oct 2006; 141 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0086

Report No.(s): AD-A474085; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474085>

Military/Civilian Medical Mutual Agreements are rarely tested but would be needed for outside Continental US (OCONUS) Mass Casualty (MASCAL) events when military bed capacity was exceeded. This AAIMS project trained Civilian and Military emergency response personnel in NDMS and NIMS for MASCAL during 3 Table top Exercises (TTX) and a Functional Exercise (FX) which: a) Tested implementation of Mutual Aid Agreement between WPAMC NDMS and Maryland EMS for MASCAL reception at BWI airport and access to civilian surge capacity bed in NDMS Hospitals; b) Assessed field deployment of the FDDMTF for MASCAL triage; c) Evaluated military/civilian communications; d) Tested the usefulness of wireless video communications in promoting EOC Situational Awareness. AAIMS was the first Maryland NDMS exercises in more than 20 years. Significant levels of military-civilian collaboration were established and Inter Agency cooperation and planning optimized for activation of NDMS. AAIMS facilitated revisions of the Maryland Emergency Operations Plan to include the NDMS activation plan across all key emergency response State Agencies. Maryland is now set to become the first state to have the NDMS plan incorporated into their Governor's Emergency Operations Plan. The FX After action Report made task specific recommendations and suggested three working groups to implement these recommendations. A future full scale NDMS exercise is planned centered in Maryland. Task specific recommendations from the AAIMS NDMS FX are shown in Appendix 1.

DTIC

Airports; Casualties; Deployment; Disasters; Industries; Medical Services; Organizations; Situational Awareness

20080003102 Nevada Univ., Reno, NV USA

High Speed Blood and Fluid Transfusion Equipment

Shires, G T; Fildes, John; Nov 1, 2007; 15 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0848; Proj-05PRO9619-00

Report No.(s): AD-A474236; OSPA 0508084; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Hypothermia occurs as the core temperature decreases below 35 degrees C. Many patients become hypothermic after

severe injury due to environmental exposure during transportation, infusion of cold fluids, and decreased ability to maintain normal core body temperature (37 degrees C). Patients with severe trauma die because of hypothermia, metabolic acidosis, coagulopathy, this phenomenon is known as the lethal triangle. Studies have shown the outcome of trauma patients with hypothermia is far worse than those with either trauma or hypothermia alone. It has been shown resuscitation requirements are increased with trauma patients who become hypothermic. Internal warming has been considered the most effective for rewarming severely hypothermic patients which involves infusion of warm fluids. In combat settings, a fluid warmer with light portability and minimal power requirement capabilities would greatly improve, the treatment of injured who are in need of fluid replacement and return core body temperature as quickly as possible to normal and prevent further complications associated with hypothermia. No such process is currently available.

DTIC

Acidosis; Blood; Body Temperature; High Speed; Hypothermia; Injuries; Metabolism; Transfusion

20080003125 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Boosting Immune Responses Against Bacterial Pathogens: In Vitro Analysis of Immunomodulators (In Vitro Analyse van de Stimulerende Werking van Verschillende Stoffen op het Immuunsysteem)

Kleij, D van der; Jul 2007; 37 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474291; TNO-DV-2007-A266; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The threat of the use of biological weapons, including bacteria, has increased. Bacterial resistance to antibiotics increasingly becomes a problem. Vaccination of military personnel against biothreat agents may be an option, however there is a broad range of biothreat agents, which may become even broader as a result of genetic engineering. Moreover, vaccination against multiple agents may cause undesired effects. A more generic approach to prevent the effects of a broad spectrum of bacteria via immunomodulation seems more effective. Three potential broad-spectrum therapeutics (MPL, MDP and ssPolyU) and their combinations were tested in an in vitro dendritic cell culture system, since dendritic cells play a central role in the development of immune responses. All combinations of modulators (but not all single modulators) enhanced DC activation, combinations with MDP acted synergistically. MDP and ssPolyU in addition enhanced the T cell polarizing capacity of DC into a response that is suitable for the combat of intracellular infections. The effects of the modulators varied when combined with different pathogens were used. The effects of MDP and ssPolyU will be studied further in an in vivo mouse infection model.

DTIC

Bacteria; Immunity; Immunology; In Vitro Methods and Tests; Physiological Responses

20080003144 Naval Postgraduate School, Monterey, CA USA

A Multivariate Analysis of Lost Work Time Due to On-the-Job Injuries at Marine Corps Commands

Robinson, Timothy J; Sep 2007; 105 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474337; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Yearly, the Department of the Navy pays about \$245 million in workers' compensation and related medical benefits under the Federal Employee Compensation Act program. (Bowes, 2003) Based on data from the Defense Manpower Data Center (DMDC) and Defense Finance and Accounting Services (DFAS), the Office of the Secretary of Defense stated that since fiscal year 2002, the number of lost workdays (LWD) the USA Marine Corps (USMC) has accumulated per hundred civilian employees has been higher than the rate for the USA Army (USA), USA Navy (USN) and USA Air Force (USAF). This thesis investigates the LWD rate of the USN and the USMC, with more detailed analysis on the USMC. The goal is to identify factors that lead to a high LWD rate and to find out which employees are more likely to accrue LWD. This study consists of the use of generalized additive models, classification trees, and descriptive statistics to explore historic datasets to determine which factors influence an employee's tendency to accrue a LWD the most. It is found that fire fighters, mechanics and police followed by equipment operators under the GS10 pay grade are at greatest risk of accruing at least one LWD per year.

DTIC

Injuries; Military Personnel; Multivariate Statistical Analysis

20080003192 Army Engineer Research and Development Center, Vicksburg, MS USA

Potential for Biodegradation of the Alkaline Hydrolysis End Products of TNT and RDX

Felt, Deborah R; Nestler, Catherine C; Davis, Jeffrey L; Larson, Steven L; Nov 2007; 88 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474432; ERDC/EL-TR-07-25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Energetic compounds, such as 2,4,6-trinitrotoluene (TNT), hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and their

degradation products, can act as a source of contamination for soil on Department of Defense testing and training ranges. Base-catalyzed hydrolysis degrades nitroaromatics and nitramines, and the potential effectiveness of this reaction in soil has been demonstrated at both bench and pilot scales. This report evaluates the potential for soil bacteria to degrade the transformation products from the alkaline hydrolysis of munitions residues. The media were obtained from the hydrolytic destruction of TNT and RDX at pH 12.5, 11.5, and 10.5. Duplicate reactors were amended with [14C]-labeled explosive compounds. Bench-scale microcosms incubated aerobically and anaerobically using grenade range soil as the inoculum and reaction mixtures (quenched and neutralized) as the media showed that there is a potential for biodegradation. Nutrient analysis confirmed the presence of increased levels of nitrite and formate following both aerobic and anaerobic incubation. TNT end products from alkaline hydrolysis were aerobically mineralized, with 16% [14C]-label recovered as CO₂. RDX reaction end products demonstrated much greater mineralization than TNT (roughly threefold). The use of alkaline material on training ranges has the potential to treat source-zone energetics contamination.

DTIC

Alkalinity; Biodegradation; Hydrolysis; RDX

20080003193 Army Engineer Research and Development Center, Vicksburg, MS USA

Algorithm Considerations for Evaluating Phosphorus Transport and Environmental Management Strategies Using a Grid-Based Spatial Watershed Model

James, William F; Johnson, Billy E; Nov 2007; 14 pp.; In English

Report No.(s): AD-A474433; ERDC-TN-SWWRP-07-11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Grid-based distributed watershed modeling can be used for estimating nutrient loading and as part of a decision support system to assess nutrient runoff risk and to identify critical nutrient sources and hydrologically sensitive areas. This technical note reviews applicable phosphorus algorithms for incorporation into the Gridded Surface Subsurface Hydrologic Analysis (GSSHA) model, suggests areas of algorithm improvement, and places grid-based spatial watershed modeling analysis within a decision support system framework.

DTIC

Algorithms; Environment Management; Hydrology Models; Phosphorus; Watersheds

20080003196 Veterans Medical Research Foundation, Inc., San Diego, CA USA

Development of Potent Orally Active Agents for Prevention and Treatment of Poxvirus Infection

Hostetler, Karl Y; Nov 2003; 107 pp.; In English

Contract(s)/Grant(s): DAMD17-01-2-0071

Report No.(s): AD-A474437; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Drugs; Infectious Diseases; Prevention; Viruses

20080003197 Medicine and Dentistry Univ. of New Jersey, Piscataway, NJ USA

RNA-Binding Proteins as Novel Oncogenes and Tumor Suppressors in Breast Cancer

Brewer, Gary; May 2005; 9 pp.; In English

Contract(s)/Grant(s): DA; MD DAMD17-03-1-0267

Report No.(s): AD-A474438; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The level of an mRNA depends upon its relative rates of synthesis and degradation. This is particularly important for oncoproteins and cell cycle proteins because their sustained synthesis favors cell growth rather than differentiation, a hallmark of the neoplastic phenotype. This control is exerted via a balance between the action of at least two RNA-binding proteins, AUF1 and HuR. AUF1 targets the degradation of mRNAs like the c-myc proto-oncogene and the cell cycle regulator cyclin D1. By contrast, HuR promotes stabilization of mRNAs. c-myc and cyclin D1 are particularly important, since both play causative roles in mammary tumorigenesis. Phase I of this work is to examine the effects of AUF1 and HuR expression levels on global gene expression in human breast carcinoma cells. Phase II is to assess the roles of AUF1 and HuR in cellular proliferation and tumorigenesis in vivo. During this funding period, we continued Phase I by transfecting expression vectors for inducible overexpression or knocked-down expression of AUF1 or HuR in human breast carcinoma cells and selecting a panel of clones. We also began identification of transcripts that are binding targets of AUF1 using mRNP immunoprecipitation (RIP) and cDNA microarray analyses of purified mRNAs.

DTIC

Breast; Cancer; Mammary Glands; Oncogenes; Proteins; Ribonucleic Acids; Suppressors; Tumors

20080003203 George Washington Univ., Washington, DC USA

Physiological Stress-Induced Drug Resistance and its Reversal

Kennedy, Katherine; Jul 2004; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9186

Report No.(s): AD-A474449; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Physiological stress conditions associated with solid tumors play a role in chemotherapeutic resistance. Treatment with hypoxia or chemical stress agents causes EMT6 mouse mammary tumor cells to develop resistance to teniposide and etoposide a topoisomerase II inhibitor. We have shown that prostaglandin A1 can fully reverse stress-induced resistance to teniposide or etoposide and the PGA1 can reverse this resistance when given either prior to or after the stress. PGA1 could also block activation of the transcription factor NF-kB as measured by gel shift assays or a luciferase reporter gene. To test whether NF-kB was directly involved in stress-induced resistance an inducible promoter plasmid system containing a mutant Ikb gene (which was non-phosphorylatable) was introduced into EMT6 cells as a dominant negative mutant. Expression of the dominant negative mutant prevented the stress activation of NF-kB and reverted the resistant phenotype to a drug sensitive phenotype. These results imply that NF-kB directly mediates both chemical and physiological stress-induced drug resistance in cancer cells and suggest that agents like PGA1 which prevent NF-kB activation may improve the efficacy of topoisomerase II inhibitors.

DTIC

Drugs; Physiology

20080003204 Illinois Univ., Chicago, IL USA

Biochemical Characterization of Native Schwannomin/Merlin

Chrishti, Athar; Sep 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0647

Report No.(s): AD-A474453; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Neurofibromatosis type 2 (NF2) is an autosomal dominant disorder characterized by the development of bilateral vestibular and spinal schwannomas meningiomas, and ependymomas. The hF2 gene encodes a 595 amino acid polypeptide known as NF2 protein or Merlin or Schwannomin. The primary structure of the NF2 protein is homologous to the ERM family of peripheral membrane proteins, which includes Ezrin, Radixin, and Moesin. The founding member of the ERM superfamily is the erythrocyte membrane protein 4.1, which cross-links spectrin-actin complexes and attaches them to the plasma membrane. We have established that p55, a palmitoylated peripheral membrane phosphoprotein, forms a ternary complex with protein 4.1 and glycophorin C. Notably, the Drosophila homologue of p55 functions as a tumor suppressor in epithelial and neuronal tissues. In the 2nd year of the funding period, we demonstrated binding between p55 and the NF2 protein and established the existence of this complex in human erythrocyte plasma membrane. This unexpected finding revealed a new paradigm, integrating the known functions of the p55 family of proteins with the pathophysiology of the NF2 protein.

DTIC

Biochemistry; Erythrocytes

20080003205 Baylor Coll. of Medicine, Houston, TX USA

The Role of the Neurofibromin-Syndecan-Cask Complex in the Regulation of Synaptic RAS-MAPK Signaling and Dendritic Spine Plasticity

Wu, Gang-Yi; Feb 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0260

Report No.(s): AD-A474457; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Neurofibromatosis type 1 (NF1) is a common dominant genetic disorder characterized by multiple benign and malignant tumors of neural origin and often cognitive deficits in children. How mutations in the NF1 gene lead to severe learning deficits is largely unknown. The protein encoded by NF1 neurofibromin contains a GAP domain known to inhibit Ras-mediated signal transduction. The objective of this proposal is to test the hypothesis that the newly identified NF1-Syndecan2-CASK signaling complex plays an essential role in the regulation of synaptic Ras-MAPK activity and dendritic spine maturation. Using several siRNAs and dominant negative constructs for NF1 GAP activity to specifically knockdown or inhibit NF1 we have obtained compelling evidence showing that NF1 deficiency indeed leads to abnormal development of dendritic spines and hyperactive Ras-MAPK activity and furthermore these deficits can be rescued by overexpression of NF1 GRD I, a central domain of NF1 responsible for its Ras GAP activity. Our results have shed new lights on the molecular mechanisms that underlie some of the

cognitive deficits in NFI patients and should have important implications for developing effective treatments of this devastating disease.

DTIC

Abnormalities; Barrels (Containers); Children; Genetics; Mutations; Plastic Properties; Spine

20080003207 Fox Chase Cancer Center, Philadelphia, PA USA

Cognitive-Affective Predictors of the Uptake & Sustained Adherence to Lymphedema Symptom Minimization Practices in Breast Cancer Survivors

Miller, Suzanne M; Aug 2007; 19 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0382

Report No.(s): AD-A474459; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Approximately 20-30% of women develop lymphedema (LE) following breast cancer treatment. Effective symptom management requires that women recognize early signs of lymphedema and maintain precautionary practices over time. Data indicates that knowledge and use of symptom minimization precautions are poor. Little is known about how breast cancer survivors perceive their LE risk and the cognitive- affective factors that promote the uptake and adherence to LE symptom minimization precautions. Guided by the Cognitive-Social Health Information Processing (C-SHIP) model we conducted a longitudinal study to assess barriers and facilitators associated with knowledge and adherence to LE symptom-minimization practices among breast cancer survivors. We are exploring the mediating role of cognitive- affective variables and the moderating role of attentional style on knowledge uptake and adherence of symptom minimization precautions at baseline 6- and 12-month follow-up post treatment. Little is known about how individuals understand and make sense of these issues and few resources have been developed to address this problem. Through systematic investigation of these factors we will be able to develop a profile of the role of cognitive-emotional processing in the management of lymphedema. These data will ultimately be used to design and evaluate enhanced management protocols tailored to the individual's cognitive-emotional signature.

DTIC

Breast; Cancer; Mammary Glands; Optimization; Predictions; Procedures; Signs and Symptoms

20080003209 Iowa Univ., Iowa City, IA USA

Vaccine Immunotherapy for Prostate Cancer. Addendum

Lubaroff, David M; Jul 2007; 97 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0462

Report No.(s): AD-A474462; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have successfully submitted clinical trial documents to regulatory agencies following a long interaction with the DOD following their approval of a three year clinical trial award.. We have received an exemption from the RAC and are awaiting final approval by the DOD's HSRRB, the University of Iowa's IRB, and the FDA.

DTIC

Cancer; Prostate Gland; Vaccines

20080003210 California State Univ., Sacramento, CA USA

Castration Induced Neuroendocrine Mediated Progression of Prostate Cancer

Evans, Christopher P; Sep 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0818

Report No.(s): AD-A474464; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the past twelve months we have demonstrated that bombesin stimulates the androgen receptor preferentially to a proximal androgen response element in the promoter region rather than in the enhancer region, which is primarily stimulated by androgens. We have shown that gastrin-releasing peptide prostate cancer cells have their growth in soft agar inhibited by the specific Src inhibitor AZD0530. This is a dose-dependent response. AZD0530 abolishes the nuclear translocation of the androgen receptor demonstrating specificity. We have also demonstrated that AZD0530 inhibits metastases of gastrin-releasing peptide prostate cancer cells in a SCID mouse model. Finally, we have delineated the downstream signaling cascades of neuroendocrine activation of androgen independent prostate cancer cell growth and have effectively inhibited these using the novel Src kinase inhibitor.

DTIC

Cancer; Endocrine Systems; Neurophysiology; Prostate Gland

20080003331 Defence Science and Technology Organisation, Victoria, Australia

Time-and Concentration-Dependent Cytotoxicity of Ricin in Human Lung Epithelial Cells

Ramasamy, Sharmaine; Proll, David; Jul 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474430; DSTO-TR-2024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ricin, a potent ribosome-inactivating hetero-dimeric protein toxin (66kDa) produced in the seeds of the castor bean plant (*Ricinus communis*), is a Category B Agent on the Centres for Disease Control (CDC) Select Agent List. Using human small airway epithelial cells, this is the first study to investigate the time- and dose-dependent cytotoxic effects of ricin in a human cell line. Ricin (1- 100pM) produced a time- and dose-dependent decrease in small airway epithelial cell survival. Ricin (10 and 100pM) reduced cell survival to 57% and 50% respectively, after 12 hours exposure and to 12% cell survival after 24 hours exposure to the toxin. Washing cells after 1-5 minutes exposure to ricin (0.01-100pM) prevented any significant ricin-induced SAE cell death. However, after washing cells exposed to ricin for 15 or 30 minutes, there was a significant reduction in SAE cell survival (84% and 71%, respectively, for 10pM and 45% and 31%, respectively, for 100pM). The results suggest that the binding of ricin to the cell surface and subsequent intracellular uptake and cell death appears to be irreversible by washing between 5 and 15 minutes following exposure to the toxin. There may be a window of opportunity for treatment, and therefore prevention, of some lung cell death up to 12 hours after aerosol exposure to ricin given that there was some survival of human lung cells after this time of exposure.

DTIC

Epithelium; Lungs; Time Dependence

20080003350 McGill Univ., Montreal, Quebec Canada

Mechanism of Antineoplastic Action of Bisperoxovanadium Compound

Scrivens, Paul J; May 2005; 18 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0478

Report No.(s): AD-A474451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This work describes studies into the mechanism of action of bisperoxovanadium (bpVs) compounds and into the basic biology and regulation of Cdc25A phosphatase. The bpVs cause phase-specific cell cycle arrest (G1/S), dose-dependent inhibition of Cdk activity, and persistent Rb hypophosphorylation upon release from serum starvation, consistent with Cdc25A inhibition. Further, they cause p53-independent apoptosis. Oxidative stress and DNA damage do not appear to be involved in their mechanism of action, given that: p53 is not induced by bpV(Me2Phen); p53 and p21 status do not affect IC50; depletion of glutathione or supplementation with antioxidants does not affect IC50, in contrast to other heavy metal-based agents. With respect to regulation, the Cdc25A nuclear localization signal (NLS) was identified and characterized. Data suggest that phosphorylation of S292, adjacent to the NLS, may promote nuclear localization. In the unperturbed cell cycle, S292 phosphorylation, a Chk1/2 target, appears to label sites of local inhibition of Cdc25A, suggesting fine tuning of the Cdc25-Cdk axis at the scale of specific subnuclear and mitotic structures.

DTIC

Deoxyribonucleic Acid; Growth

20080005232 Army Research Inst. of Environmental Medicine, Natick, MA USA

Exertional Heat Illness and Human Gene Expression

Sonna, L A; Sawka, M N; Lilly, C M; Jan 2007; 27 pp.; In English

Report No.(s): AD-A474505; MISC-06-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Microarray analysis of gene expression at the level of RNA has generated new insights into the relationship between cellular responses to acute heat shock in vitro, exercise, and exertional heat illness. Here we discuss the systemic physiology of exertional hyperthermia and exertional heat illness, and compare the results of several recent microarray studies performed in vitro on human cells subjected to heat shock and in vitro on samples obtained from subjects performing exercise or suffering from exertional heat injury. From these comparisons, a concept of overlapping component responses emerges. Namely, some of the gene expression changes observed in peripheral blood mononuclear cells during exertional heat injury can be accounted for by normal cellular responses to heat, exercise, or both; others appear to be specific to the disease state itself. If confirmed in future studies, these component responses might provide a better understanding of adaptive and pathological responses to exercise and exercise-induced hyperthermia, help find new ways of identifying individuals at risk for exertional heat illness, and perhaps even help find rational molecular targets for therapeutic intervention.

DTIC

Blood Cells; Gene Expression; Genes; Injuries; Proteins; Ribonucleic Acids; Sicknesses; Thermal Shock

20080005235 Air Force Research Lab., Wright-Patterson AFB, OH USA

Bio-Based Approaches to Inorganic Material Synthesis (Postprint)

Slocik, Joseph M; Stone, Morley O; Naik, Rajesh R; Mar 2007; 7 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474510; AFRL-ML-WP-TP-2007-543; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nature is exquisite designer of inorganic materials using biomolecules as templates. Diatoms create intricate silica wall structures with fine features using the protein family of silaffins as templates. Marine sponges create silica spicules also using proteins, termed silicateins. In recent years, our group and others have used biomolecules as templates for the deposition of inorganic materials. In contrast with the traditional materials science approach, which requires high heat, extreme pH and non-aqueous solutions, the bio-based approaches allow the reactions to proceed usually at near ambient conditions. Additionally, the biological templates allow for the control of the inorganic nanoparticle morphology. The use of peptides and biomolecules for templating and assembling inorganics will be discussed here.

DTIC

Biochemistry; Inorganic Chemistry; Lysine; Silicon Dioxide

20080005236 Colorado School of Mines, Golden, CO USA

Indirect Detection Of Bacillus Anthracis (Anthrax) Using Amplified Gamma Phage-Based Assays

Reiman, Robert W; Nov 1, 2007; 152 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474517; CI07-0069; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The need for a simple, specific, sensitive, inexpensive, accurate, and rapid method to identify *Bacillus anthracis* became apparent during the Fall 2001 anthrax attacks which caused widespread panic and ultimately killed five individuals. The Centers for Disease Control and Prevention currently employs agar plate lysis by gamma phage and direct fluorescence assay to confirm the presence of *Bacillus anthracis*. These confirmatory methods require isolation of individual colonies from an overnight culture, are time consuming, and are best suited for laboratory environments. The research described in this dissertation focused on applying the highly specific gamma phage lytic replication cycle to indirectly detect *Bacillus anthracis*. The production of progeny gamma phage only occurs in the presence of a suitable host, so the detection of increasing concentrations, or amplification, of progeny gamma phage implies the presence of viable *Bacillus anthracis* cells. Four unique gamma phage-based detection assays using real-time polymerase chain reaction, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry, and two different designs of hand-held immunoassays based on this gamma phage amplification phenomenon were designed, developed, and experimentally tested for indirectly detecting viable *Bacillus anthracis*. This research demonstrated that vegetative *Bacillus anthracis* was required to produce the gamma phage amplification event. Real-time polymerase chain reaction was used to detect the increased amount of gamma phage DNA produced by gamma phage amplification, and thereby indirectly detect a starting concentration of four *Bacillus anthracis* cells in less than five hours. The other three gamma phage-based detection assays were unable to indirectly detect *Bacillus anthracis*, but three of the four assays demonstrated gamma phage detection capabilities.

DTIC

Assaying; Bacillus; Bacteriophages; Biological Effects; Deoxyribonucleic Acid; Detection; Gamma Rays; Infectious Diseases

20080005242 Army Research Inst. of Environmental Medicine, Natick, MA USA

Comparison of Model Predictions to Core Temperature Responses During Prolonged Intermittent Exercise

Blanchard, Laurie; Chevront, Samuel N; Goodman, Daniel A; Aug 2007; 3 pp.; In English

Report No.(s): AD-A474532; P07-76; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USARIEM Heat Strain Decision Aid (HSDA) is an empirically developed tool for mission planning and prevention of heat injury. HSDA uses information about the individual, their environment, clothing, and activity to estimate core temperature (T_c) and calculate recommended safe work times. Data from a recent series of experiments was used to validate the performance of HSDA for the conditions studied.

DTIC

Cores; Eating; Health; Injuries; Physical Exercise; Sicknesses

20080005262 University of Pittsburgh Medical Center, PA USA

Ft. Sam 91 Whiskey Combat Medic Medical Simulation Training Quantitative Integration Enhancement Program

Phrampus, Paul; Love, Kimberly; Apr 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0049

Report No.(s): AD-A474568; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The training of the combat field medic is a critical need of the USA Army. The 91W program at Fort Sam Houston, Army Medical Department (AMEDD), Department of Combat Medic Training (DCMT), trains over 7,000 Combat Field Medics per year. Increased training consolidation in the armed services has put increased demands on the training program at the DCMT at Fort Sam Houston (FSH). Efficiency and effectiveness of training are important goals that are continually undergoing evaluation by the leadership structure of the DCMT. To ensure a continuous quality improvement implementation strategy, the DCMT training center leadership requires feedback on the type of training needed by combat field medic trainees. They are also in need of information concerning how to revise the curriculum to continually meet a high state of readiness to support the Army's medical mission. Additionally, it is beneficial to understand how a soldier's previous experiences, as well as their participation in various continuing education activities, influence their performance on critical skills. There is a need for formalized assessment of combat field medic skills retention and investigation of the ideal method of retraining, taking into account previous experience.

DTIC

Augmentation; Combat; Education; Medical Services; Military Operations; Military Personnel; Simulation

20080005263 Loma Linda Veterans Association for Research and Education, Loma Linda, CA USA

Gene Therapy for Fracture Repair

Lau, William; May 2007; 73 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0685

Report No.(s): AD-A474569; No Copyright; Avail.: Defense Technical Information Center (DTIC)

These studies examined approaches to optimize gene therapy for the repair of endochondral bone fractures. Several components of a gene therapy approach were examined, including viral vectors and associated regulatory elements, vector delivery to the fracture tissues, and the application of a combination of genes with different functions in bone formation and tissue repair. It was found that the murine leukemia-based viral vector, with transgene expression mediated by the long terminal repeat, provided more robust, though unregulated, gene expression than the lentiviral vector transgenes expressed from either non-specific or bone-specific promoters. Viral vector delivery was important in promoting fracture healing, as demonstrated through an intramedullary technique for vector application. The application of a combination of fibroblast growth factor-2 and bone morphogenetic protein-4 transgenes, that mediate proliferation and osteogenesis, respectively, suggested that combination gene therapy could be an important clinical approach for bone healing. Microarray studies also characterized global gene expression during the early inflammation phase and the later endochondral bone formation phase of normal fracture healing. Several thousand genes displayed expression changes during fracture healing, including genes that have been associated with tissue regeneration, and identified candidates for future fracture repair studies using optimized vectors and delivery techniques.

DTIC

Bones; Fractures (Materials); Fracturing; Gene Therapy

20080005265 Pennsylvania State Univ., Hershey, PA USA

Role of Heterochromatin Epigenetic Factors in CML

Grigoryev, Sergei A; Aug 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0386

Report No.(s): AD-A474571; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the reported period, our main goal was to test and further develop a hypothesis that structural modifications and/or interference between two heterochromatin proteins: MNEI and HP1 lead to abnormal gene regulation and impaired myeloid differentiation, CML acceleration, blast crises and/or secondary acute leukemia. In specific aim 1, we isolated monomeric and high molecular forms of MNEI by chromatography and gel electrophoresis and determined their primary structure by mass spectroscopy to identify the high molecular MNEI bands as those originating from MNEI and its complexes with a protease, neutrophil elastase. We designed peptides and raised antibodies against MNEI/elastase complex and specific peptides exposed in the modified MNEI. We found that these antibodies recognize MNEI65 expressed in a subset of CML cases including the blastic form of CML. In specific Aim 2 we conducted experiments on expressing MNEI and HP1 in leukemia cell lines. Cell cultures derived from a blastic CML cell model K562 expressing both MNEI and HP1 were raised and characterized for their

chromatin structure and proliferation ability showing that expression of MNEI does not interfere with HP1 and other heterochromatin markers but significantly inhibits cell proliferation. This inhibition requires intact protease inhibitory activity of MNEI. Our results suggest that MNEI interferes with myeloid proliferation independently of heterochromatin proteins but through forming complexes with its target proteases such as neutrophil elastase.

DTIC

Leukemias; Proteins

20080005266 BBNT Solutions, LLC, Cambridge, MA USA

An Evaluation of Stereoscopic Digital Mammography for Earlier Detection of Breast Cancer and Reduced Rate of Recall

Getty, David J; Aug 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0295

Report No.(s): AD-A474572; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this project is to evaluate, in a screening context, stereoscopic digital mammography versus standard (non-stereo) digital mammography for earlier detection of breast lesions during screening and for reduction in the rate of patient recall for further work-up. As of July 2007, 1093 patients at elevated risk for the development of breast cancer have been enrolled. Each patient receives both a standard screening examination and a stereoscopic screening examination which are read independently by different radiologists. If a suspicious finding is reported from either reading, the patient is recalled for standard clinical workup examinations, which form the basis for lesion truth. Compared to standard digital mammography, stereo mammography is significantly reducing false positive lesion detections by 48% ($p < 0.0001$), and significantly reducing false negative reports by 40% ($p < 0.06$). ROC analysis of the readers' judgments of the likelihood that a finding is real show significantly greater accuracy for stereo, $A_z = 0.78$, than for standard, $A_z = 0.55$ ($p = 0.0001$).

DTIC

Breast; Cancer; Detection; Display Devices; Mammary Glands

20080005267 California Univ., Berkeley, CA USA

Breast Cancer in Context: New Tools and Paradigms for the Millennium

Bissell, Mina J; Jul 2007; 57 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0438

Report No.(s): AD-A474575; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We hypothesized that breast tumors are capable of multiple differentiation pathways. A finite number of interconnected pathways establish homeostasis in normal tissues which, if still functional in tumors, may be manipulated for therapy. Our goal was to characterize a large number of breast cancer cell lines with known genomic profiles as surrogates for human breast cancers utilizing a robust 3-dimensional assay with laminin-rich extracellular matrix (3D IrECM) with the aim of discovering new pathways to be targeted by combinations of drugs. In this assay non-malignant mammary epithelial cells form breast-like acinar structures whereby cells growth arrest and polarize while tumorigenic cells proliferate as a disorganized mass. Tumor cells treated with a number of signaling inhibitors alone or in combination are phenotypically reverted or killed. We have found that tumor cell lines adopt one of 4 distinct 3D morphologies which provide a finer delineation than hierarchical clustering of expression profiles of cell lines in 2D alone and that these morphologies may be reflective of their biological origin and phenotypic properties, such as degree of invasiveness. We have also found that the 3D microenvironment exerts common changes in expression profiles across all cell lines that are associated with signal transduction activity. Most importantly, we have shown that response to chemotherapeutic agents and radiation are fundamentally different in 2D and 3D assays with the latter more closely predicting in vivo response.

DTIC

Breast; Cancer; Mammary Glands

20080005268 Northeastern Ohio Univ. Coll. of Medicine, Rootstown, OH USA

Prevalence and Outcomes of Restless Legs Syndrome among Veterans

Bourguet, Claire C; Sep 2007; 123 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0082

Report No.(s): AD-A474579; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Restless Legs Syndrome (RLS) is a neurological disorder characterized by unpleasant, abnormal feelings in the legs and occasionally arms which occur at rest and when initiating sleep. The sufferer experiences an uncontrollable urge to move in

order to relieve symptoms. RLS interferes with the ability to fall asleep or to maintain sleep. The resulting sleep deprivation can interfere with family life, social activities, and job performance. RLS is a commonly underdiagnosed organic cause of insomnia. There is evidence that insomnia leads to psychic distress which impacts health care utilization. The purpose of this study was to examine a proposed model that links RLS to insomnia, and insomnia to reduced mental health and increased health care utilization. The study estimates the prevalence of RLS, insomnia, mood disorders, and substance abuse; quantifies the proportion of mood disorders and substance abuse that are attributable to RLS and insomnia; documents the diagnosis of RLS and insomnia; and estimates the association of RLS and insomnia to health care utilization and health-related quality of life. The author conducted a cross-sectional survey of a representative sample of Ohio Veterans Administration clients using telephone interviews and data extracted from medical records. A 1-year followup of health care utilization was performed using postal questionnaires and medical records. The results showed that the prevalence of RLS and insomnia are high (22% and 16%, respectively) in this population, as are mental health disorders (major depression 20%, anxiety disorder 12%, phobias 14%, panic attack 6%, and alcohol dependence 3%). Less than 5% of RLS was documented in the medical records. RLS is associated with insomnia (PR = 1.5, p<.001) and 20% of the insomnia may be attributed to RLS. The burden of insomnia might be reduced by 20% in this population with effective treatment of RLS.

DTIC

Disorders; Drugs; Health; Insomnia; Medical Services; Mental Health; Moods; Motion; Signs and Symptoms

20080005318 New Mexico Univ., Albuquerque, NM USA

Motivational Interviewing in the Prevention of Alcohol Abuse

Moyers, Theresa B; Aug 2007; 123 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0681

Report No.(s): AD-A474584; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study represented an effort to test whether standard training strategies, commonly used effectively in civilian providers, were effective in training Air Force Behavioral Health Providers in a specific empirically based treatment (EBT): motivational interviewing (MI). Employing a randomized, controlled design, providers were randomized to receive either standard training in MI or an enriched training option. The standard training option was a 2-day workshop on MI, while the enriched option added follow-up consultation and personalized feedback regarding a work sample to the workshop. After training, providers submitted work samples at 4, 8, and 12 months to assess the impact of the training conditions. These work samples were evaluated using standardized behavioral coding systems to measure both the provider behaviors and the client responses to them. Questions to be answered in this study include the efficacy of training procedures, their cost-effectiveness in reducing alcohol-related events on participating bases, and the impact of pre-training counseling skills on acquiring MI.

DTIC

Alcohols; Armed Forces (United States); Drugs; Education; Health; Military Personnel; Prevention

20080005319 Veterans Medical Research Foundation, Inc., San Diego, CA USA

The Effects of Total Sleep Deprivation and Recovery Sleep on Cognitive Performance and Brain Function

Drummond, Sean P; Aug 2007; 37 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0201

Report No.(s): AD-A474587; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An ever-increasing number of military personnel and civilians alike must work daily without adequate sleep. Although considerable data show that sleep deprivation alters many aspects of behavior, little is known about changes in the brain substrate underlying the behavioral effects, and even less is known about the cerebral effects of recovery sleep. The overarching objective of this study is to investigate the effects of 2 full nights of sleep loss (66 hours total) and 2 full nights of recovery sleep on cognitive performance and brain function. The authors studied 40 individuals for 6 nights and 6 days. Over the course of this period, subjects received 4 polysomnograms and 10 functional magnetic resonance imaging (fMRI) sessions. During the fMRI sessions, functional brain imaging data were collected while subjects performed each of three cognitive tasks. These data provide a rich amount of information concerning the effects of prolonged total sleep deprivation and recovery sleep on cognitive performance and the cerebral underpinnings of that performance. The initial manuscripts from this study have shown the following: (1) the course of deterioration and recovery in cognitive inhibitory processes, (2) changes during sleep deprivation in brain networks responsible for new learning, (3) changes in risk taking during sleep deprivation, and (4) the specific components of working memory impaired by sleep deprivation and individual differences in vulnerability to working memory deficits during sleep deprivation.

DTIC

Cerebral Cortex; Cognition; Learning; Mental Performance; Sleep; Sleep Deprivation

20080005320 New Orleans Univ., LA USA

Development of Magnetic Nanomaterials and Devices for Biological Applications

O'Connor, Charles J; Hormes, Josef; Bazan, Nicolas; Oct 30, 2007; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): HR0011-04-C-0068; ARPA ORDER NO-S327/00

Report No.(s): AD-A474588; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes a research project in the area of bio-magnetic interfacing concepts aimed at the development of magnetic nanomaterials and devices for biological applications. Novel bio-compatible ferrofluids of functionalized magnetic nanoparticles suitable for bioconjugation of antibodies or other active biomolecules are developed, prepared, and tested for use in biomedical research, and various biological and clinical diagnostic applications.

DTIC

Biomedical Data; Magnetic Materials; Medical Science; Nanoparticles; Nanotechnology

20080005326 Pennsylvania Univ., Philadelphia, PA USA

A Novel Strategy for Controlling the Metastatic Phenotype: Targeting the SNAG Repression Domain in the SNAIL Zinc-Finger Protein

Rauscher, III, Frank J; Jul 2007; 207 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0631

Report No.(s): AD-A474599; No Copyright; Avail.: Defense Technical Information Center (DTIC)

BCRP Award has funded fundamental new discoveries into how a key protein involved in the metastatic process of breast cancer functions. We have discovered the following: 1. The SNAIL zinc finger repressor must bind its obligate co-repressor AJUBA, in order to repress e-cadherin and initiate metastasis. 2. The AJUBA interaction is direct and highly specific and this complex can be found at endogenous SNAIL target genes. 3. The binding requires the 20 amino acid SNAG domain of SNAIL and a single LIM domain of AJUBA. This binding forms a well-defined protein-protein interaction, which may be targeted by small molecules to interfere with the metastatic process during breast cancer progression.

DTIC

Breast; Cancer; Fingers; In Vitro Methods and Tests; In Vivo Methods and Tests; Mammary Glands; Metastasis; Proteins; Snails; Zinc

20080005327 California Univ., Berkeley, CA USA

Smad Acetylation: A New Level of Regulation in TGF-Beta Signaling

Tu, Andrea W; Jul 2007; 24 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0357

Report No.(s): AD-A474600; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The transforming growth factor (TGF) signaling pathway is an essential pathway whose initiation results in cell growth arrest in most epithelial cells. Activation of TGF receptors leads to the phosphorylation and translocation of the Smad proteins, the major TGF intracellular signaling molecule, to the nucleus where transcription of TGF target genes occur. Many breast cancers contain aberrations in the regulation of Smad proteins demonstrating the importance of TGF signaling. Therefore, understanding how posttranslational modifications may regulate this pathway will increase our knowledge of how a normal cell becomes cancerous and may provide insight into novel therapeutics. This proposal suggests a series of experiments designed to study the acetylation of Smad proteins. We have determined that Smad2 can be efficiently acetylated by the acetyltransferase protein p300 in vivo and in vitro and that this acetylation is necessary for the transcriptional activity of the protein in Smad2-deficient mouse embryonic fibroblasts. This decrease in transcriptional activity is due to the inability of non-acetylated Smad2 to accumulate in the nucleus upon TGF treatment and translates into marked decrease in the TGF induced cell cycle arrest that is essential for the tumor suppressing ability of the TGF signaling pathway.

DTIC

Acetylation; Breast; Cancer; In Vitro Methods and Tests; In Vivo Methods and Tests; Mammary Glands

20080005328 Massachusetts General Hospital, Boston, MA USA

Early Detection of Breast Cancer by Fluorescence Molecular Tomography

Ntziachristos, Vasilis; Jul 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W8X1XWH-04-1-0239

Report No.(s): AD-A474601; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Molecular targeting approaches have tremendous potential for early-detection because they rely on elucidation of

abnormal gene-expression, rather than on discovery of retarded anatomical changes inflicted by growing tumors upon their microenvironment. We investigated whether fluorescence molecular tomography (FMT) could be used to detect breast cancer at its earliest stages via the detection of injected, protease-activatable molecular probes. We have successfully completed all goals and achieved the three major aims of the proposal, i.e. i) the development of appropriate fluorescence imaging methods for highly reliable and quantitative fluorescence imaging ii) the establishment and imaging of appropriate animal models of spontaneous breast cancer that closely resembles human disease as a pre-clinical stage to clinical translation and finally iii) generated predictions on clinical utility by simulations and phantom measurements based on the in-vivo findings from the animal studies. It is demonstrated for the first time that molecular based detection of breast cancer is possible based on fluorescent signatures using fluorescence probes. This shift the paradigm of breast cancer detection, treatment monitoring and follow up of disease progression in clinically relevant settings.

DTIC

Breast; Cancer; Clinical Medicine; Detection; Fluorescence; Mammary Glands; Tomography

20080005330 Pittsburgh Univ., Pittsburgh, PA USA

Effect of HER-2/Neu Signaling on Sensitivity to TRAIL in Prostate Cancer

Lee, Yong J; Jun 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0440

Report No.(s): AD-A474604; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long-term goal of our research project is to develop a novel therapy for HER-2/neu overexpressing prostate cancer. Previous studies have shown that the HER-2/neu homodimer constitutively activates the PI(3)K-Akt-NF- B signal transduction pathway. During the research period, we examined whether the PI(3)K-Akt-NF- B signal transduction pathways are involved in tumor necrosis factor-related apoptosis-inducing ligand (TRAIL)-induced apoptosis. As a first step we investigated whether modulation of the PI3K-Akt - NF- B signals affects TRAIL-induced cytotoxicity. We observed that acetylsalicylic acid (ASA: aspirin), amiloride, and quercetin inhibit the PI(3)K-Akt signal transduction pathway and promote TRAIL-induced cytotoxicity in HER-2/neu overexpressing human prostate cancer cells. The second step we examined how these chemical compounds enhances TRAIL cytotoxicity. We observed that ASA promotes TRAIL cytotoxicity by down-regulating SURVIVIN gene expression. We believe that the outcome of these studies provides information to support the development and clinical application of TRAIL for the treatment of HER-2/neu overexpressing human prostate cancer.

DTIC

Cancer; Clinical Medicine; Pathology; Prostate Gland; Sensitivity

20080005332 Colorado Univ., Aurora, CO USA

Exercise to Counteract Loss of Bone and Muscle During Androgen Deprivation Therapy in Men with Prostate Cancer

Kohrt, Wendy M; Glode, L M; Schwartz, Robert S; Barry, Daniel W; May 2007; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0276

Report No.(s): AD-A474607; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The original objective was to determine whether a 1-year intensive resistance exercise training (RT) program is more effective than a moderate-intensity walking program in ameliorating the effects on body composition of androgen deprivation therapy (ADT) in men with prostate cancer. It was postulated that: 1) RT will attenuate the declines in bone mineral density (BMD) and fat-free mass (FFM) to a greater extent than walking; and 2) both RT and walking will prevent an increase in fat mass. Primary outcomes are lumbar spine BMD and FFM. Secondary outcomes are: total body and hip BMD; fat mass; markers of bone turnover; serum sex hormones; physical functional performance; quality of life, and risk factors for cardiovascular disease (blood lipids, glucose tolerance, arterial stiffness). Because of the inability to enroll the projected number of participants, the study protocol was modified at the time of the 2006 annual IRB review to focus only on the intensive resistance training intervention.

DTIC

Bone Mineral Content; Bones; Cancer; Deprivation; Education; Hormones; Human Beings; Losses; Males; Minerals; Muscles; Physical Exercise; Prostate Gland; Therapy

20080005333 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA

Serum Genetic Markers as Surrogates of Prostate Cancer Progression

Hoon, Dave S; Apr 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0261

Report No.(s): AD-A474608; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main purpose of the proposal is that detection of free tumor-related DNA marker(s) in serum can be used as surrogate

genetic markers for monitoring ongoing events related to the pathogenesis of metastasis and provide prognostic insight into disease outcome and treatment response. The scope of the studies is to develop and validate tumor-related circulating DNA in serum of prostate cancer (PCA) patients. The goal is to validate these DNA markers. We have developed assays for circulating serum DNA in prostate cancer patients (PCA). The program has gotten on track in the past year since the approval of the Human subjects IRB. PCA patient s and normal donor serum was accrued in the past year. We have been screening for new circulating methylated and unmethylated tumor-related DNA markers. Several DNA markers were found to correlate with PCA stage significantly. Highly sensitive assays were developed to detect these DNA markers in serum. Optimal conditions to obtain high specificity and sensitivity were determined. In the coming year more PCA patients will be accrued as well as further accrual of normal age-matched donors for the study. Assays for the markers will be carried out. We plan to complete the study in the upcoming year.

DTIC

Cancer; Genetics; Markers; Prostate Gland; Serums

20080005337 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Detection of the Host Immune Response to Burkholderia mallei Heat-Shock Proteins GroEL and DnaK in a Glanders Patient and Infected Mice

Amemiya, Kei; Meyers, Jennifer L; Deshazer, David; Riggins, Renaldo N; Halasohoris, Stephanie; England, Marilyn; Ribot, Wilson; Norris, Sarah L; Waag, David M; Jan 2007; 12 pp.; In English

Report No.(s): AD-A474615; TR-07-016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We examined, by enzyme-linked immunosorbent assay and Western blot analysis, the host immune response to 2 heat-shock proteins (hsps) in a patient and mice previously infected with Burkholderia mallei. The patient was the first reported human glanders case in 50 years in the USA. The expression of the groEL and dnaK operons appeared to be dependent upon a sigma(32) RNA polymerase as suggested by conserved heat-shock promoter sequences, and the groESL operon may be negatively regulated by a controlling invert repeat of chaperone expression (CIRCE) site. In the antisera, the GroEL protein was found to be more immunoreactive than the DnaK protein in both a human patient and mice previously infected with B. mallei. Examination of the supernatant of a growing culture of B. mallei showed that more GroEL protein than DnaK protein was released from the cell. This may occur similarly within an infected host causing an elevated host immune response to the B. mallei hsps.

DTIC

Bacteria; Immunity; Infectious Diseases; Mice; Patients; Physiological Responses; Proteins; Thermal Shock

20080005342 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Gene Expression Profiling of Nonhuman Primates Exposed to Aerosolized Venezuelan Equine Encephalitis Virus

Koterski, James; Twenhafel, Nancy; Porter, Aimee; Reed, Douglas S; Martino-Catt, Susan; Sobral, Bruno; Crasta, Oswald; Downey, Thomas; DaSilva, Luis; Dec 2007; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474625; USAMRIID-PR-06-043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Host responses to Venezuelan equine encephalitis viruses (VEEV) were studied in cynomolgus macaques after aerosol exposure to the epizootic virus. Changes in global gene expression were assessed for the brain, lungs, and spleen. In the brain, major histocompatibility complex (MHC) class I transcripts were induced, while the expression of S100b, a factor associated with brain injury, was inhibited, as was expression of the encephalitogenic gene MOG. Cytokine-mediated signals were affected by infection, including those involving IFN-mediated antiviral activity (IRF-7, OAS, and Mx transcripts), and the increased transcription of caspases. Induction of a few immunologically relevant genes (e.g. IFITM1 and STAT1) was common to all tested tissues. Herein, both tissue-specific and nontissue specific transcriptional changes in response to VEEV are described, including induction of IFN-regulated transcripts and cytokine-induced apoptotic factors, in addition to cellular factors in the brain that may be descriptive of the health status of the brain during the infectious process. Altogether, this work provides novel information on common and tissue-specific host responses against VEEV in a nonhuman primate model of aerosol exposure.

DTIC

Aerosols; Encephalitis; Gene Expression; Genes; Infectious Diseases; Primates; Viruses

20080005346 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Three Minutes-Long Electrophoretically Assisted Zeptomolar Microfluidic Immunoassay with Magnetic-Beads Detection

Morozov, V N; Groves, S; Turell, M J; Bailey, C; Oct 24, 2007; 3 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): C52-04NA25455

Report No.(s): AD-A474648; TR-07-086; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An ultrasensitive two-step immunoassay was developed for rapid assay of proteins and viruses. In the first step, electrophoresis was used to quickly bring soluble analytes from a flowing solution to a microarray of probe molecules immobilized on a semi-permeable membrane. In the second step, the captured analyte was detected by scanning the microarray with functionalized magnetic beads passed over the array surface by shear flow and pressed to the array surface by a magnetic field.

DTIC

Beads; Electrophoresis; Immunoassay; Magnetic Fields; Microfluidic Devices

20080005350 Library of Congress, Washington, DC USA

The Cost of Iraq, Afghanistan, and Other Global War on Terror Operations Since 9/11

Belasco, Amy; Jun 28, 2007; 46 pp.; In English

Report No.(s): AD-A474663; CRS=RL33110; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With enactment of the FY2007 suppl 2007 supplemental on May 25, 2007, Congress has approved a total of about \$610 billion for military operations, base security, reconstruction, foreign aid, embassy costs, and veterans health care for the three operations initiated since the 9/11 attacks: Operation Enduring Freedom (OEF) in Afghanistan and other counterterrorism operations; Operation Noble Eagle (ONE), providing enhanced security at military bases; and Operation Iraqi Freedom (OIF). The \$611 billion total covers all war-related appropriations from FY2001 through the May 25, 2007, enactment of the FY2007 Supplemental (H.R. 2206/P.L. 110-28) including both funds in supplementals and regular appropriations acts for DOD, State Department/AID, and VA Medical costs. For FY2007, funds for Iraq and Afghanistan were appropriated in the FY2007 Supplemental, DOD supplemental, FY2007 Appropriations (H.R. 5631/P.L. 109-109-289), and the Year-Long Continuing Resolution (H.J. Res. 20/P.L. 110-5). Of the \$610 billion appropriated thus far, CRS estimates that Iraq will receive about \$450 billion (74%), OEF about \$127 billion (21%), and enhanced base security about \$28 billion (5%), with about \$5 billion that CRS cannot allocate (1%). Of this total funding, 93% of the funds is for DOD, 7% for foreign aid programs and embassy operations, and less than 1% for medical care for veterans. For DOD, war appropriations rose steeply in FY2007. DOD received \$165.8 billion for war costs in FY2007 more than 40% more than the previous year and 50% more than OMB estimated last summer.

DTIC

Afghanistan; Costs; Health; Iraq; Medical Services; Military Operations; Warfare

20080005352 Massachusetts General Hospital, Boston, MA USA

Systemic Oncolytic Cytokine HSV Therapy of Prostate Cancer

Passer, Brent J; May 1, 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0367

Report No.(s): AD-A474667; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of the present work is to evaluate the use of HSV oncolytic vectors and their cytokine-containing derivatives as potential therapeutic modalities in treating prostate cancer. To this end, we have exploited the use of the transgenic TRAMP mouse, which recapitulates the developmental hallmarks of prostate cancer in humans. In last year's progress report, we made substantial strides in addressing all three specific aims. This year, we have added additional experiments to solidify this work and have subsequently submitted a manuscript entitled, Systemic therapy of spontaneous prostate cancer in transgenic mice with oncolytic herpes simplex viruses to Cancer Research to be reviewed for publication (see attached manuscript in appendix). Furthermore, we have recently implemented a novel complementary approach using human prostate explants derived from cancer biopsies to further assess the efficacy of oncolytic HSV virotherapy. Our preliminary data shows that oncolytic HSV specifically targets epithelial cells within the prostatic ducts and remarkably, leaves the surrounding stroma unaffected.

DTIC

Cancer; Infectious Diseases; Prostate Gland; Therapy; Viral Diseases

20080005354 Scripps Research Inst., La Jolla, CA USA

An Oral DNA Vaccine Encoding Endoglin Eradicates Breast Tumors by Blocking Their Blood Supply

Reisfeld, Ralph A; May 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0489

Report No.(s): AD-A474671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In an effort to meet the urgent need for the development of novel and effective treatments for metastatic breast cancer, we developed and evaluated a novel, oral DNA vaccine targeting endoglin (CD105). This target molecule, overexpressed on proliferating endothelial cells in the breast tumor neovasculature, proved most efficacious as this vaccine specifically activated antigen-presenting dendritic cells (DCs), induced effective immune responses by CD8⁺ T cells against endoglin-positive target cells and markedly suppressed tumor angiogenesis. We could prove by in vivo immunodepletions that the vaccine, delivered by gavage with attenuated *Salmonella typhimurium* to Peyer's patches in the small intestine, specifically activated CD11c⁺ OCs and their costimulatory molecules CD80 and CD86 as well as CD8⁺ T cells. Together, these effects led to a strong suppression of pulmonary metastases of D2F2 breast carcinoma cells in a syngeneic mouse tumor model. It is anticipated that this new vaccine strategy can be translated to clinical application to evaluate its use for the treatment of breast cancer.

DTIC

Blocking; Blood Volume; Breast; Coding; Deoxyribonucleic Acid; Plasmids; Proteins; Tumors; Vaccines

20080005355 Alabama Univ., Birmingham, AL USA

A Targeted Multifunctional Platform for Imaging and Treatment of Breast Cancer and Its Metastases Based on Adenoviral Vectors and Magnetic Nanoparticles

Everts, Maaik; Saini, Vaibhav; Aug 2007; 53 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0630

Report No.(s): AD-A474672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Nanotechnology holds many promises for the imaging and treatment of breast cancer. In particular, magnetic nanoparticles can be utilized for tumor imaging via magnetic resonance imaging (MRI) techniques and tumor treatment by heating after exposure to an alternating magnetic field. However, selective targeting of the nanoparticles to the tumor cells needs to be accomplished before the imaging or therapy can be successful. In this respect, adenoviral (Ad) vectors for gene therapy have made great progress in achieving successful tumor targeting after their intravenous administration. We therefore hypothesized that coupling magnetic nanoparticles to targeted Ad vectors would allow the selective localization of these particles to the tumor, thereby making imaging and therapy possible. We herein identified that coupling the nanoparticles to the Ad capsid protein hexon does not perturb vector infectivity or retargeting efficiency in vitro. Furthermore, we have demonstrated the intracellular accumulation of nanoparticles targeted to breast cancer cells using this system. We will continue this project by identifying novel magnetic nanoparticles with optimal magnetic contrast properties for imaging and treatment of breast cancer cells, and will also broaden our project's scope by including Quantum Dots in addition to magnetic nanoparticles for the imaging of tumors. This will further our goal to develop multifunctional systems for targeting, imaging and treatment of cancer.

DTIC

Breast; Cancer; Imaging Techniques; Mammary Glands; Metastasis; Nanoparticles

20080005356 Georgetown Univ. Hospital, Washington, DC USA

Antibody Induced Perturbation-A New Method to Identify Pathways in Breast Cancer Progression, Invasion and Metastasis

Johnson, Michael D; Jan 2006; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0205

Report No.(s): AD-A474674; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is a critical need for markers of metastasis that will allow patients who are node negative to be separated into two groups: those who need further therapy and those who have been cured by their surgery. We hypothesized that changes in cellular biochemistry, that need not involve changes in the expression of particular genes, are important determinants of metastatic behavior, and we further hypothesized that many of these changes might be mimicked by the binding of an antibody with the right binding characteristics. We set out to test the idea that novel determinants of metastatic behavior could be identified by expressing single chain antibodies inside non-metastatic cells, and then screening those cells for the acquisition of a more metastatic phenotype. The antibody responsible for this increased metastatic ability would then be isolated from these cells and used to identify the protein with which it interacted. The project has met with significant technical challenges which have slowed progress. Nevertheless, significant progress has been made to overcome these difficulties and we anticipate

being able to complete the study, having been granted a no-cost extension of one year.

DTIC

Antibodies; Breast; Cancer; Mammary Glands; Metastasis; Perturbation Theory

20080005357 Van Andel Research Inst., Grand Rapids, MI USA

Integrin-Mediated Signaling in Prostate Cancer: Role of KAI1/CD82 in Regulating Integrin and Androgen Receptor Function During Metastasis

Miranti, Cynthia K; Sep 2007; 64 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0044

Report No.(s): AD-A474675; No Copyright; Avail.: Defense Technical Information Center (DTIC)

How prostate tumors become metastatic is virtually unknown. A prostate metastasis suppressor gene, KAI1/CD82, known to associate with laminin receptors, allowed us to test the hypothesis that loss of KAI1/CD82 expression alters the function of laminin integrins in prostate cancer cells, resulting in altered intracellular signaling and increased invasion leading to metastasis. We have demonstrated that in metastatic tumor cells, where elevated c-Met expression and activation by integrins is responsible for enhancing laminin-dependent migration and invasion, re-expression of CD82 suppresses, while loss of CD82 enhances c-Met activation. Orthotopic injection of CD82-expressing metastatic cells into mouse prostates suppresses both metastasis and growth in vivo. CD82 appears to regulate c-Met activation by altering the distribution of c-Met on the cell surface, possibly through CD82 association with another tetraspanin, CD9, and their joint association with PI integrin. Our studies have advanced the knowledge of how members of the tetraspanin family function and are potentially applicable to all metastatic disease, since KAI1/CD82 loss has been reported in many types of cancers. Our results suggest that targeting c-Met would be a logical approach to therapeutic intervention of metastatic disease. Our findings further suggest that together CD82 expression and c-Met activation could be used as a potential biomarker pair for the prediction of metastatic disease. In addition we have shown that the PI-3K/Akt pathway is critical for laminin-specific survival in metastatic prostate cells, but activation of the androgen receptor (AR) by-passes the need for PI-3K signaling when cells are adherent to laminin. Since over 90% of metastatic prostate cancers still express AR, targeting the PI-3K pathway alone would not be sufficient to kill tumors in a laminin-rich environment.

DTIC

Cancer; Hormones; Males; Metastasis; Prostate Gland

20080005358 Institute for Cancer Research, Philadelphia, PA USA

Radiopaque, Tumor-Targeted Nanoparticles for Improved Mammographic Detection of Breast Cancer

Adams, Gregory P; Aug 2007; 7 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0591

Report No.(s): AD-A474676; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Despite the widespread use of X-ray mammography for routine breast cancer (BC) screening the technique suffers from a number of major limitations including a false-negative rate of at least 10-15% and a positive predictive value (PPV2) of only 25-40%. Accordingly a large number of patients either do not receive treatment when they should or are subjected to needless physical and emotional trauma. The weakness of X-ray mammography stems from its poor ability to a) image small or noncalcified lesions particularly in patients with high breast density and b) to distinguish between benign and malignant microcalcifications. A tumor-selective X-ray contrast agent would mitigate both of these limitations. This proposal was focused on developing radiopaque gold nanoparticles targeted to HER2 a BC-relevant antigen. Administered intravenously these conjugates should accumulate preferentially at tumors enhancing visualization due to the presence of the gold. Interpretation could be aided by subtraction imaging or comparison to a baseline mammogram performed prior to contrast injection. The major objective were 1) to determine the ability of nanogold clusters to detectably alter X-ray mammograms performed using plastic phantoms 2) to develop nanogold conjugates using small engineered antibody fragments and 3) to perform initial in vivo targeting studies with these conjugates.

DTIC

Breast; Cancer; Detection; Mammary Glands; Nanoparticles; Tumors

20080005359 Baylor Coll. of Medicine, Houston, TX USA

Novel Transgenic Mouse Model for Testing the Effect of Circulating IGF-I on Mammary Stem/Progenitor Cell Number and Tumorigenesis

Lee, Adrian V; Aug 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0628

Report No.(s): AD-A474677; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epidemiological evidence indicates that high levels of circulating IGF-I (within the normal range) predict risk of breast cancer. To examine this experimentally investigators have previously injected mice with IGF-I and shown that this increases mammary cancer incidence and progression. However injection of IGF-I may create non-physiological peaks of IGF-I in the circulation. In this proposal we tested whether transgenic mice (TTR-IGF-I) that had a 30% increase in circulating levels of IGF-I (via liver specific expression) had altered ErbB2-induced mammary tumorigenesis. We found no difference in time to tumor formation in ErbB2 vs. TTR-IGF-I/ErbB2 transgenic mice. Our conclusion is either that ErbB2-induced tumorigenesis is insensitive to circulating IGF-I or other studies using injected IGF-I were confounded by the transient spike in IGF-I caused by the non-physiologic method of administration. Further studies using additional mouse models are required to definitively address a role for circulating IGF-I in mammary tumorigenesis however our data suggest that the IGF-I may not directly regulate risk but rather may be an indicator of another risk factor.

DTIC

Breast; Cancer; Circulation; Mammary Glands; Mice; Stem Cells

20080005360 Massachusetts Univ. Medical Center, Worcester, MA USA

Improving Breast Cancer Diagnosis by Antisense Targeting

Wang, Yi; Aug 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0649

Report No.(s): AD-A474678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this investigation is to use anti-Her2 antibody Herceptin as carrier and streptavidin as linker to specifically transport antisense into tumor cells expressing Her2. For this purpose we successfully conjugated MAG3/biotin to antisense/sense morpholino oligomers (MORFs) and conjugated biotin group to Herceptin. The MORF-streptavidin-Herceptin constructs have been synthesized and their quality has been confirmed. We have confirmed by confocal microscopy using fluorescent lissamine as the tag that Herceptin can mediate the cellular internalization of MORFs and more important the internalized oligomer distributed in cytoplasm evenly without apparent entrapment in cellular compartments. By using ^{99m}Tc as the tag we also have approved that the antisense can be released from the internalized antisense-streptavidin-Herceptin construct. These results are significant and encouraging for the followed studies in in vivo antisense tumor targeting using Herceptin as carrier.

DTIC

Antigens; Breast; Cancer; Diagnosis; Mammary Glands; Oligomers; Therapy; Tumors

20080005361 Texas Univ. Health Science Center, San Antonio, TX USA

Identifying Breast Cancer Bone Metastasis Genes

Sun, LuZhe; Aug 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0616

Report No.(s): AD-A474683; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Bone metastasis is one of the major causes of morbidity and mortality in breast cancer (BC) patients. However, only a few human BC cell lines can efficiently metastasize to bone whereas most BC cell lines cannot. Recently, it was shown that systemic administration of the conditioned medium by a melanoma cell line redirected the metastatic dissemination of a weakly metastatic lung carcinoma cell line to the organ sites that were metastasized by the melanoma cell due to the formation of metastasis-permissive niches by bone marrow-derived cells (BMDCs) in these organ sites. The current project was proposed to test the hypothesis that factors secreted by metastasis-competent BC cells may condition bone marrow for the successful homing and skeletal remodeling of circulating BC cells. Athymic nude mice were treated with media conditioned by metastasis-competent BC cells and then inoculated with nonmetastatic BC cells in arterial circulation. The treatment induced limited bone metastasis. Bone histology analysis is currently being performed.

DTIC

Bones; Breast; Cancer; Identifying; Mammary Glands; Metastasis; Oncogenes

20080005363 Creighton Univ., Omaha, NE USA

Novel in Situ Gel Drug Delivery System for Breast Cancer Treatment

Dash, Alekha K; Jul 2007; 16 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0426

Report No.(s): AD-A474685; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The rationale of this study was to utilize the overproduction of mucin in cancerous cells as a drug targeting strategy to develop a safe and effective delivery system for taxol. Since the chemotherapeutic agents do not discriminate cancer cells and normal tissue, highly effective cancer treatment agents such as taxol cause major toxicity to normal tissue. This toxicity can be fatal if not prevented. The hypothesis for this project was a mucoadhesive in situ gel delivery system containing paclitaxel can be targeted to the cancerous cells where MUC1 gene is overexpressed as compared to normal cells and substantially reduce its toxicity to normal cells. The primary objective of this investigation is to develop a sustained release novel in situ gel delivery system for the targeted local delivery of taxol. The delivery system was designed so that when injected close to the site of tumor, at the biological pH (7.4), the ionic polymer used in the delivery system would deprotonate and turn into an instant gel at the site of injection. This will provide a sustained release of paclitaxel (PIX) from the gel at and around the site of cancer while the systemic drug concentration will be negligible. The specific aims of this study are: 1) formulation, and physicochemical characterization of the in situ gel delivery system, and 2) evaluation of the effectiveness of the targeted local in situ gel delivery system versus the systemic delivery and determination of the local tissue and organ toxicity of the delivery system.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Gels; Mammary Glands

20080005365 Cleveland Clinic Foundation, Cleveland, OH USA

Novel Role of Prostate-Specific Membrane Antigen in Prostate Cancer Invasion and Metastasis

Ghosh, Arundhati; Apr 2007; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0618

Report No.(s): AD-A474688; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate Specific Membrane Antigen, PSMA is a type II transmembrane glycoprotein, overexpressed in prostate carcinoma (PCa) including androgen sensitive and independent disease, increased in expression with early relapse following therapy. PSMA is a carboxypeptidase with two important enzymatic functions, namely, folate hydrolase and NAALADase. We have used in vitro invasion assays to explore the possible role of PSMA in PCa cells. Androgen dependent PCa lines, which express PSMA endogenously (e.g., LNCaP, CWR22) are less invasive compared to androgen independent PSMA negative PC3 or DU145 cells. Ectopic expression of PSMA in PC3 cells reduced the invasiveness of these cells, suggesting that this reduction in the invasion capability of PSMA expressing cells is due to PSMA expression, not due to intrinsic properties of different cell lines. Expression of PSMA mutants lacking carboxypeptidase activity reduced the impact of PSMA expression on invasiveness. Thus it appears that the enzymatic activity is associated with PSMA's effect on cellular invasiveness. To test our experimental results in vivo, we have further co-expressed PSMA and luciferase reporter gene in highly invasive PC3MM2 lines. We obtained several expressors with high luciferase and PSMA expression. Tumor formation ability and metastatic potential of these lines will be tested in mice.

DTIC

Antigens; Cancer; Enzymes; Membranes; Metastasis; Peptides; Prostate Gland

20080005366 Wisconsin Univ., Madison, WI USA

Implications of Stem Cell Growth Regulation for Breast Cancer

Alexander, Caroline M; Jun 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0491

Report No.(s): AD-A474690; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We propose that mammary stem cells could be involved in tumor development in either of two ways. The first is that altered function could change the course of development, and affect the susceptibility to transformation in adult life. We have found and characterized a model to test this hypothesis, and have preliminary array data to describe these cell populations. The second way that mammary stem cells could affect tumor development is by direct recruitment of these cells as tumor precursors. We have characterized a model of carcinogen-induced tumor development, and show that canonical stem cells are highly sensitive to genotoxins, and unlikely to be direct precursor cells. In order to study the factors that regulate mammary epithelial cell growth, we have chosen to examine their interaction in microchannels. These are very small-scale culture devices that allow for the culture of cells in defined media in low volumes. We have found that mammary stem/progenitor cells

induce the division of the cell majority, suggesting an entirely novel function for this group of cells.
DTIC

Breast; Cancer; Carcinogens; Cell Division; Mammary Glands; Mathematical Models; Stem Cells

20080005367 Maryland Univ. Baltimore County, Catonsville, MD USA

Immune Suppression and Inflammation in the Progression of Breast Cancer

Bunt, Stephanie K; Mar 2007; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0276

Report No.(s): AD-A474695; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epidemiological and experimental evidence supports the concept that chronic inflammation promotes the development and progression of cancers; however, the mechanisms underlying this relationship are poorly understood. We have demonstrated previously that secretion of the pro-inflammatory cytokine interleukin 1beta (IL-1beta) from 4T1 mammary carcinoma cells (4T1/IL-1beta) promotes tumor progression and decreases the survival of tumor-bearing animals. Tumor progression in many patients and experimental animals with cancer is frequently associated with the expansion of a population of myeloid cells, termed Myeloid-derived Suppressor Cells (MDSC). These cells have potent immunosuppressive activity and inhibit both innate and adaptive immunity by inhibiting T cell activation, NK cell cytotoxicity, and reducing the number of mature dendritic cells. Chronic inflammation at the tumor site enhances and alters the quality of MDSC by inducing a phenotypically and functionally distinct population of MDSC, which are more potent suppressors of CD8+ T cells. Using mice deficient for the IL-1 receptor (IL-1R^{-/-}), we demonstrate that reducing inflammation delays tumor growth, the development of lung metastases, and the expansion of MDSC. MDSC in an inflammation-deficient environment are phenotypically and functionally similar to MDSC in wild-type BALB/c mice. Here we demonstrate that inflammation-induced MDSC skew immunity towards a type-2 response by reducing IL-12 production by macrophages and producing elevated levels of IL-10. In addition to the delays in MDSC induction, reducing inflammation prevent the accumulation of a more potent population of MDSC induced by inflammation, as MDSC from IL-1R^{-/-} mice produce similar levels of IL-10 as BALB/c mice. These data suggest that limiting tumor-associated inflammation may delay the onset of systemic immune suppression that accompanies breast cancer progression and may enhance the efficacy of current and future therapies.

DTIC

Breast; Cancer; Immune Systems; Interleukins; Mammary Glands; Suppressors; Tumors

20080005369 California Univ., San Francisco, CA USA

Use of Synthetic Nerve Grafts to Restore Cavernous Nerve Function Following Prostate Cancer Surgery: In Vitro and In Vivo Studies

Konety, Badrinath R; Sep 2007; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0038

Report No.(s): AD-A474698; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hypothesis of this proposal is that interposition of micropatterned biodegradable polymer based nerve grafts to replace resected or damaged cavernous nerves can facilitate return of erectile function by engendering directional nerve growth in an animal model. Micropatterned grafts have been produced using a biodegradable polymer (PDFA). The groove characteristics obtained by micropatterning will be optimized to allow maximal directional neurite growth have been optimized. The effect of laminin +/- polylysine, Schwann cell and neuronal stem cells on neurite growth are being investigated. Tubulized sheets of the polymer with and without these factors/cells have been used to microsurgically replace resected cavernous nerve in male Sprague-Dawley rats. Control groups consisting of ungrafted animals as well as those grafted with native genitofemoral nerve have been generated. After an interval of 2 months, we have attempted to observed the restoration of physiologic function of the cavernous nerve by electrical stimulation of the nerve and/or pelvic ganglion. We are in the process of analyzing the tissue sections of the grafts that have been harvested to look for nNos expression and fluorogold staining which would indicate re-establishment of nerve integrity since that would be required to allow travel of fluorogold injected into the penile tissue to the pelvic ganglion.

DTIC

Cancer; Cells (Biology); Grafting; In Vitro Methods and Tests; In Vivo Methods and Tests; Nerves; Nervous System; Prostate Gland; Surgery

20080005370 Texas Univ. Health Science Center, San Antonio, TX USA

Investigation of the Akt/Pkb Kinase in the Development of Hormone-Independent Prostate Cancer

deGraffenried, Linda A; Feb 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0218

Report No.(s): AD-A474699; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our laboratory has been interested in the role of Akt in the development of hormone-independent cancers. Using a breast cancer cell model, we previously demonstrated that tumors with a constitutively active Akt are resistant to anti-hormone therapy. In this study we have expanded upon our preliminary observations in the breast model into in vitro prostate cancer models to determine the molecular and biological mechanisms underlying these findings. In our second year of this study, we found that treatment with an Akt inhibitor prevented the progression of LNCaP cells to a state of androgen-independence. These results correlated with suppression of expression of the androgen receptor, as well as suppression of the pro-survival proteins bcl-2 and NF-kB. We are currently exploring the significance of these findings in relationship to the preventive properties of the omega-3 fatty acids. Currently, progression of prostate cancer to androgen independence remains the primary obstacle to improved survival with this disease. The results of our studies suggest that targeting the Akt pathway may provide a strategy for preventing progression, resulting in increased survival among patients with recurrent disease.

DTIC

Cancer; Hormones; Prostate Gland

20080005371 Burnham Inst., La Jolla, CA USA

Cas Signaling in Breast Cancer

Vuori, Kristiina; May 2007; 15 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0523

Report No.(s): AD-A474700; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Antiestrogens have proven to be effective in the treatment of hormone-responsive breast cancer. In metastatic breast cancer, antiestrogens lead to a response in nearly one half of patients. Resistance to antiestrogens, however, is a serious clinical problem. About 40% of ER-positive tumors fail to respond to antiestrogen therapy, and most breast tumor patients that initially respond will eventually develop resistance. A recent mutagenesis approach has identified three independent loci associated with antiestrogen resistance, and the target genes of two of the loci, BCAR1 and BCAR3, have been characterized. Sequence analysis of BCAR1 demonstrated it to code for the docking protein p130Cas (Cas), which we and others have previously identified to be a key molecule in intracellular signaling pathways. Subsequent studies demonstrated that enhanced activation of Cas signaling can induce antiestrogen resistance, at least in cell culture conditions. Recent studies have demonstrated that Cas is likely to have a relevant role also in clinical breast cancer; studies on breast cancer samples have shown that high levels of Cas expression correlate with poor relapse-free and overall survival, and the response to tamoxifen therapy in patients with recurrent disease was found to be reduced in patients with primary tumors that expressed high levels of Cas. Our hypothesis supported by our preliminary data was that Cas has an important causal role in the development of antiestrogen resistance. As a corollary, understanding of the pathways that Cas activates may identify key regulators of antiestrogen resistance and novel clinical targets for breast cancer treatment, and measurements of Cas signaling levels may provide useful prognostic information for breast cancer patients. In this grant, our objective was to test our hypothesis, and to identify and characterize the signaling pathways that mediate Cas-induced antiestrogen resistance.

DTIC

Breast; Cancer; Hormones; Mammary Glands

20080005372 California Univ., Berkeley, CA USA

Bioavailability of TGF-Beta in Breast Cancer

Illa-Bochaca, Irineu; Barcellos-Hoff, Mary H; Jul 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0488

Report No.(s): AD-A474704; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Transforming Growth Factor beta (TGF-b) superfamily includes three isoforms designated TGF-b1, b2 and b3. All three isoforms are secreted as latent complex where the TGF-b cytokine is non-covalently associated with an isoform specific latency-associated peptide (LAP). Mature cytokine binds cell surface receptors only after release from its LAP making extracellular activation a critical regulatory point for TGF-b bioavailability. Proposed activation mechanisms include proteolysis and conformational changes. Previous work from our laboratory showed that latent TGF-b1 (LTGF-b1) is efficiently activated upon exposure to reactive oxygen species (ROS). ROS activation is restricted to the LTGF-b1 isoform. Because of the amino acid sequence differences between the three LAPs, we postulate that the specificity of this activation

mechanism lies within the LAP. Furthermore, we hypothesize that the presence of a metal in the latent complex could provide a redox active center for this process. Redox mediated activation provides a novel mechanism for TGF- β participation in tissues undergoing oxidative stress. Moreover, this would allow TGF- β 1 to act both as a sensor of oxidative stress within tissues as well as a transducer of that signal by binding to its cellular receptors.

DTIC

Breast; Cancer

20080005373 Louisiana Univ., Monroe, LA USA

Role of Myelofibrosis in Hematotoxicity of Munitions RDX Environmental Degradation Product MNX

Meyer, Sharon A; Sep 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0537

Report No.(s): AD-A474705; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to determine mechanisms through which hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine (MNX), environmental degradation product of high energetic munition hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), causes persistent anemia in the rat. We have hypothesized MNX targets hematopoietic stem cells and, like other myelosuppressive chemicals, will be fibrogenic to the bone marrow. Findings of this period are: 1) the inability of RDX and MNX to directly oxidize hemoglobin ferrous iron to methemoglobin in vitro and of MNX to produce methemoglobin in MNX-treated rats, an alternative mechanism for the observed anemia and 2) nitramine targeting of an early multipotential bone marrow stem cell at earlier times after exposure (7d) and flow cytometric assessment of myeloid and erythroid lineage precursors. Collectively, these results continue to suggest an early erythroid/myeloid lineage precursor and/or to the bone marrow stromal niche supporting hematopoiesis as the target of MNX and RDX. These results suggest that MNX- and RDX toxicity in the rat appears to mimic some clinical manifestations of the myeloproliferative disorder, idiopathic myelofibrosis, and thus may offer a model for study of disease progression and intervention strategies.

DTIC

Anemias; Degradation; RDX

20080005374 Delaware Univ., Newark, DE USA

Predicting Bone Metastatic Potential of Prostate Cancer Via Computational Modeling of TGF-Beta Signaling

Cooper, Carlton R; Ogunnaike, Babtunde; May 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0071

Report No.(s): AD-A474707; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We demonstrate that transforming growth factor beta 1 (TGF-1), a common growth factor in the bone marrow, reduces the adhesion of metastatic prostate cancer (PC) cells to bone marrow endothelial cells (BMEC), but increases the adhesion of these same cells to collagen type I, a major component of the bone matrix. Also, we show that metastatic PC cells are inhibited by TGF-1 in a dose dependent fashion. The expression of TGF-1 receptors type I and II are increased in metastatic PC cells and these observations provide a unique opportunity to use mathematical modeling to decipher the complex TGF-1 signaling pathway required for PC metastasis. We are well on our way to understanding this pathway with the hope of using the information gained to better access the metastatic potential of PC.

DTIC

Bone Marrow; Bones; Cancer; Metastasis; Predictions; Prostate Gland

20080005376 Boston Medical Center Corp., Boston, MA USA

Allele Imbalance or Loss of Heterozygosity in Normal-Appearing Breast Epithelium as a Novel Marker to Predict Future Breast Cancer

Rosenberg, Carol L; Jul 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0395

Report No.(s): AD-A474710; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this study is to determine whether the occurrence of AI/LOH in the DNA of histologically normal epithelium from non-cancerous breasts predicts future breast cancer development. If so, then AI/LOH would be an excellent candidate molecular marker of increased sporadic breast cancer risk: its incidence increases during cancer development, it can be quantified and standardized, it is likely to reflect dysregulation of genetic mechanisms that could be potential targets for pharmacological modulation. In the past year, we have made substantial progress on the first two of our four aims. From the Nurses Health Study Benign Breast Disease nested case-control sub study, cases and matched controls have been identified

and their tissue blocks sent to the PI's laboratory for study; and the techniques to quantitate AI/LOH in an automated fashion are being finalized. In the next year, we anticipate continued progress on the tasks as outlined in the statement of work.
DTIC

Breast; Cancer; Epithelium; Losses; Mammary Glands; Markers

20080005377 Texas Univ. Health Science Center, San Antonio, TX USA

Anti-Androgen Receptor RNA Enzyme as a Novel Therapeutic Agent for Prostate Cancer in Vivo

Chen, Shuo; Aug 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0253

Report No.(s): AD-A474711; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prostate cancer is the second leading cause of cancer death among men in the western world. Androgen plays a crucial role in the development and growth of normal prostate gland and prostate cancer. Action of androgen is mediated by an androgen receptor (AR) and the AR exerts androgen-regulated gene expression. Standard therapy relies on androgen ablation to remove or block the action of androgens. This therapy results in a regression of the tumor because most primary tumor cells depend on androgens for growth. However, most prostate cancers eventually relapse as their tumors progress to androgenrefractory. Studies have indicated that the AR gene amplification and mutations are involved in androgen-refractory tumors. Therefore, blockage of the AR gene expression might provide a new approach to the management of the AR-dependent cancer. We have developed anti-AR RNA enzymes that are able to selectively and specially interact with the AR mRNA and cleave the AR mRNA in vitro. Unlike conventional chemotherapy, the enzymes would have lesser side effects because the compounds selectively destroy only the AR gene. This study proposed is to determine specific efficacy of these enzymes in vivo.

DTIC

Cancer; Enzymes; Genes; Hormones; In Vivo Methods and Tests; Males; Prostate Gland; Ribonucleic Acids; Therapy

20080005378 Pennsylvania State Univ., University Park, PA USA

Novel Anticancer Agents that Block Dissociation of Hsp90 from Estrogen Receptors in Breast Cancers

Peterson, Blake R; Mar 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0722

Report No.(s): AD-A474712; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Heat shock protein 90 (Hsp90) is a chaperone protein that facilitates the folding of estrogen receptors (ERs) and other proteins involved in breast cancer proliferation. This protein is under investigation as a target of anticancer drugs because breast cancer cells contain Hsp90 in an activated high affinity conformation that is particularly susceptible to Hsp90 inhibitors. These inhibitors include the anticancer agent geldanamycin (GDM), which is thought to inhibit the proliferation of cancer cells in part by blocking agonist-induced release of steroid hormone receptors such as ERs from Hsp90. To further stabilize this interaction, we synthesized estrogen receptor ligands coupled to GDM to enforce heterodimerization of ER and Hsp90 in mammalian cells. We demonstrated that at a concentration of 10 micromolar, an estrone (E1)-GDM chimera can heterodimerize recombinant ER and Hsp90 proteins in vitro. Moreover, competition experiments established that this compound stabilizes interactions between ERs and Hsp90 in human cells. These studies demonstrated that bifunctional small molecules can affect ERs by heterodimerization with Hsp90, providing a new strategy for inhibiting ERs involved in breast cancer proliferation.

DTIC

Breast; Cancer; Cells (Biology); Dissociation; Estrogens; Hormones; Mammals; Mammary Glands

20080005380 Delaware Univ., Newark, DE USA

Integrated Molecular Imaging and Therapy for Breast Cancer

Panchapakesan, Balaji; Aug 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0668

Report No.(s): AD-A474716; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this project, we have demonstrated multi-component molecular targeting of surface receptors (IGF1R and Her2) and NIR dosing of cancer cells using SWCNT. While previous studies have shown the transport of DNA into cells using nanotubes, in this study we show multicomponent molecular targeting of both IGF1R and Her2 surface markers in cancer cells using single wall carbon nanotubes. IGF1 and Her2 specific antibodies conjugated to the SWCNT were used to target their corresponding receptors in cells and internalize the SWCNT. The cells were then dosed with NIR 808 nm photons at ~800

mW/sq cm for 3 minutes. Cells that were treated with non-specific antibody-SWCNT hybrids survived the NIR dosing compared to the dead cells with anti-IGF1- anti-Her2-SWCNT hybrids. The amount of energy consumed for cell killing was estimated to be as small as ~200 nW per cell, which is an order of magnitude smaller than competing techniques. Quantitative estimates showed that cells incubated with SWCNT-anti-Her-anti-IGF1R antibodies were completely destroyed while 80% of the non-specific-antibody-SWCNT hybrids treated cells were still alive. These results indicate that SWCNT could be used as biological transport agents and the high optical absorbance in the NIR are capable of killing cancer cells with minimum collateral damage. Further, western blots indicated the relevance of targeting IGF1R in MCF7 cancer cells and Her2 in BT474 breast cancer cells. This study is another clear example of molecular targeting and cell killing approach that can improve therapeutic efficacies. These tools can also be applied to traditional surgical oncology to improve the probability of killing cancer cells whose microscopic foci are often left behind in surgery.

DTIC

Breast; Cancer; Imaging Techniques; Mammary Glands; Therapy

20080005381 Auckland Univ., New Zealand

A Rat Model of Systemic Chemotherapy for Breast Cancer to Evaluate and Treat Chemobrain

Little, Kevin C; Sep 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0736

Report No.(s): AD-A474717; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary objective of this project was to develop an animal model to measure possible cognitive deficits resulting from chemotherapy. We have established a rat model of multidose human-equivalent combination chemotherapy using cyclophosphamide methotrexate and 5-fluorouracil (CMF) that recapitulates the physical symptoms of chemotherapy treatment. We investigated the effects of this regimen on learning and memory as well as on the production and survival of new neurons in the hippocampus (neurogenesis). We found no statistically significant differences between control and CMF animals on any measure of learning or memory nor with respect to neurogenesis.

DTIC

Breast; Cancer; Chemotherapy; Cognition; Mammary Glands; Rats

20080005383 Case Western Reserve Univ., Cleveland, OH USA

Id2 as an Integrator of Oncogenic Stimuli in Breast Cancer

Keri, Ruth A; Aug 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0542

Report No.(s): AD-A474721; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This proposal focused on the role of Inhibitor of Differentiation (Id) proteins, which are transcription factors, in mammary gland development and carcinogenesis. Although Id2 regulates mammary gland growth and development and is important for myc-induced transformation of certain cell types, its role in breast cancer has not been thoroughly addressed. We have found that Id2 is upregulated in two mouse models of breast cancer: one that involves hormone-induction of carcinogenesis and the other involves overexpression of HER2/neu. In contrast, Id1 expression is reduced in both models. These data suggest that Id2 may be a common integrator of oncogenic stimuli in breast and that Id1 may suppress breast carcinogenesis. The goals of this work were to determine, using transgenic mouse models, if Id2 is necessary and sufficient for mammary gland tumorigenesis in mice. If so, this would suggest that Id2 or processes regulated by this transcription factor may serve as useful prognostic markers or therapeutic targets in breast cancer.

DTIC

Breast; Cancer; Carcinogens; Integrators; Mammary Glands; Proteins; Tumors

20080005389 North Dakota State Univ., Fargo, ND USA

A Novel Membrane-Permeable, Breast-Targeting, Pro-Apoptotic Peptide for Treatment of Breast Cancer

Guo, Bin; Oct 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0705

Report No.(s): AD-A474733; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this project, we tried to create a novel peptide with three properties: membrane permeable, breast targeting, and inducing apoptosis. The peptide is expected to be able to induce apoptosis specifically in breast cancer cells and will be tested as a single therapeutic agent as well as in combination with chemotherapeutic drugs to treat breast cancer. For specific aim 1, we have synthesized the breast-targeting, membrane permeable, pro-apoptotic peptide. The BH3 peptide of Bid

(EDIIRNIARHLAQVGDSDMR) has been synthesized with eight darginine residues at the N-terminus with a glycine linker residue, followed by a breast-homing sequence (CPGPEGAGC) at the C-terminal. A control peptide with a mutation in the BH3 domain was also synthesized, r8-BH3(L/E)-CPGPEGAGC. Next, we have tested the therapeutic efficacy of the peptide in treatment of breast cancer. The peptide was tested for apoptosis induction first in vitro in cultured breast cancer MCF-7 cells. However, this peptide failed to induce apoptosis in MCF-7 cells at the concentrations being tested. We tried to produce an alternative peptide, which has similar design and predicted functions but with stronger apoptosis inducing capability. The synthesis of the new peptide was not completed. In parallel studies, we have developed a novel strategy using Valproic acid to enhance apoptosis induced by TRAIL in cancer cells. The effects of VPA on apoptosis appear to be due to the down-regulation of survivin and Bcl-XL

DTIC

Apoptosis; Breast; Cancer; Mammary Glands; Membranes; Peptides

20080005390 Kansas Univ., Lawrence, KS USA

Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling

Yang, KyoungLang; Georg, Gunda I; May 1, 2006; 17 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0434

Report No.(s): AD-A474734; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cryptophycins are a potent tumor-selective class of tubulin-binding antimetabolic anti-cancer agents with excellent activity against MDR cancers. In order to develop these promising compounds into useful chemotherapeutic agents it is necessary to obtain detailed information about the binding domain of the cryptophycins on tubulin. We plan to map the cryptophycin binding site through photoaffinity labeling studies. Toward this goal, we have synthesized and studied the activity of C16 side chain azido analogues and synthesized C6 dimethyl and C10 azido analogues of cryptophycin-24, by means of inventing an improved synthetic route to achieve the synthesis of diverse analogues in a more efficient way.

DTIC

Chemotherapy; Drugs; Marking

20080005598 California Univ., Los Angeles, CA USA

The Origin and Significance of Mammary Intraductal Foam Cells

Barsky, Sanford H; Sep 2005; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0712

Report No.(s): AD-A474713; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474713>

Intraductal 'foam cells' are the most commonly encountered cells in spontaneous nipple discharge, aspirates, and lavage, and frequently surround DCIS and other intraductal proliferations. The origin of these cells is thus of potential importance, but is not presently understood. This project tested the hypothesis that these intraductal macrophages take origin from bone marrow-derived hematopoietic precursors. The central work tests the idea by transfer of bone marrow from C57BL/6 mice recombinantly expressing green fluorescent protein (GFP) into wildtype GFP- recipients. After transfer, mice were hormonally manipulated for mammary epithelial stimulation, and evaluated for recruitment of GFP+ cells (hematopoietic origin) associated with mammary epithelium. The prediction of foam cells with hematopoietic origin was not confirmed. However, we showed that precursor cancer stem cells of hematopoietic origin developed in mammary tissue with both benign and malignant differentiation, depending on environmental cues. Progression of the cells to cancer is associated with the up-regulation of c-kit and Sca-1, and was regulated by the PIWI/AGO family gene piwil2. This demonstrates a surprising contribution of hematopoietic precursors to the heterogeneity of cell types in benign and malignant mammary tissue.

DTIC

Foams; Mammary Glands

20080005599 Pennsylvania Univ., Philadelphia, PA USA

A Biophysico-Computational Perspective of Breast Cancer Pathogenesis and Treatment Response

Weaver, Valerie M; Mar 2007; 245 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0330

Report No.(s): AD-A474715; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474715>

Apoptosis resistance regulates breast transformation and treatment responsiveness, yet the mechanism(s) enhancing breast

cancer cell survival remain unclear. We showed that malignant transformation is associated with increased matrix deposition, cross-linking and reorganization that correlate with a progressive stiffening of the gland. Organotypic culture experiments demonstrated that stiffening the extracellular matrix (ECM) destabilizes cell-cell junctions, enhances integrin-dependent adhesions, alters survival, and compromises mammary morphogenesis and the integrity of differentiated mammary tissues. Matrix force also promotes oncogene-mediated invasion and malignant transformation of mammary epithelial cells (MECs) in culture and in vivo, by inducing cell-generated force and RhoGTPase, ERK, PI3 kinase and JNK signaling. Consistently, deterministic modeling predicted that chronically-activated ERK drives cell transformation, and while the model does not incorporate adhesion-dependent force, we did find that pre-malignant MECs with genetically modified integrins have elevated ERK signaling, and are invasion in culture and tumorigenic in vivo. We are now testing whether inhibiting ECM stiffening or changing integrin signaling will either prevent or promote malignant transformation in vivo.

DTIC

Breast; Cancer; Mammary Glands; Pathogenesis; Therapy; Tumors

20080005600 Duke Univ., Durham, NC USA

Stromal-Epithelial Interactions and Tamoxifen-Sensitivity: A Bench-to-Beside Model of Chemoprevention

Rowell, Craig; May 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0467

Report No.(s): AD-A474719; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474719>

Funding of this multidisciplinary training program supports efforts to 1) use Random Periareolar Fine Needle Aspiration (RPFNA) to test for correlations between a) hyper-methylation of estrogen responsive genes b) estrogen responsive protein expression by immunohistochemistry (IHC) and a cytological response to tamoxifen chemoprevention and then 2) test whether resistance to tamoxifen correlates with lack of co-activator recruitment to an estrogen response element (ERE) in state-of-the-art preclinical models. We have established and validated methylation specific PCR primers for the detection of two isoforms of the Progesterone Receptor in Random Periareolar Fine Needle Aspiration (RPFNA) samples. Likewise we have developed protocols to evaluate the steroid hormone concentration in RPFNA samples. Preliminary investigation of steroid concentration indicates that there may be a positive correlation between breast tissue estradiol concentration and cytological atypia.

DTIC

Epithelium; Estrogens; Genes; Scale Models

20080005602 Congressional Budget Office, Washington, DC USA

Reforming the Military Health Care System

Jan 1988; 139 pp.; In English

Report No.(s): AD-A474725; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474725>

High costs, wide beneficiary dissatisfaction, and inadequate readiness for war have stirred widespread interest in changing the military's system of health care. Large sums are at stake because of the military health care system's scope. The Army, Navy, and Air Force run 129 hospitals (medical centers and regional and community hospitals), and several hundred outpatient clinics in the USA. About 9 million people are entitled to use these facilities, including not only the 2.2 million men and women serving on active duty but their roughly 3 million dependents along with about 4 million retired military personnel and their dependents and survivors. Caring for dependents and retirees nonactive beneficiaries in military facilities costs the Defense Department more than \$3 billion a year. When nonactive beneficiaries cannot obtain care directly from the armed forces, because a particular medical service is unavailable or because military facilities in general are hard to reach, they may use the Civilian Health and Medical Program of the Uniformed Services (CHAMPUS). CHAMPUS pays a large part of the costs of care obtained from civilian hospitals and doctors. Dependents and retirees can use CHAMPUS whenever they want for outpatient care, but for hospital care those living in a 'catchment area'-the area roughly 40 miles around a military hospital must get specific permission from their local military medical commander. In recent years funding for CHAMPUS has tripled, from about \$710 million in 1980 to more than \$2 billion in 1987. In response, the Administration has put forward the CHAMPUS Reform Initiative (CRI), which has at its core several fixed-price contracts with private health care companies to provide care for beneficiaries who are not on active duty. Though it may save money, CRI also carries a risk of triggering much higher costs.

DTIC

Clinical Medicine; Cost Analysis; Cost Effectiveness; Costs; Health; Hospitals; Medical Services; Military Operations

20080005604 Tohoku Univ., Sendai, Japan

Development of Health Monitoring Techniques for Composite Structures

Fukunaga, Hisao; Hu, Ning; Nov 7, 2007; 153 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0076

Report No.(s): AD-A474730; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474730>

The purpose of this project is to develop two kinds of composite structural health monitoring approaches. One is a passive element based on the impact force identification combined with a database. This database can quickly evaluate the impact-induced damages in composites by employing the identified impact force. It can be built up by using a powerful numerical model for impact damage evaluation with the help of experimental data. Another is an active element based on the Lamb wave. These two stable and reliable structural health monitoring techniques can then be used to more practical situations. The majority of the aims of this project have been successfully achieved. The major achievements of our group have been the following: 1) an efficient impact force identification technique without resort to numerical models has been developed; 2) a powerful numerical model based on the finite element method for predicting the impact-induced damages has been built up; 3) a Lamb wave based on structural health monitoring technique without baseline data has been developed which is used in metallic and composite structures.

DTIC

Composite Structures; Health

20080005608 Case Western Reserve Univ., Cleveland, OH USA

D2 as an Integrator of Oncogenic Stimuli in Breast Cancer

Keri, Ruth A; Sep 1, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0542

Report No.(s): AD-A474744; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474744>

This proposal focused on the role of Inhibitor of Differentiation (Id) proteins, which are transcription factors, in mammary gland development and carcinogenesis. Although Id2 regulates mammary gland growth and development and is important for myc-induced transformation of certain cell types, its role in breast cancer has not been thoroughly addressed. We have found that Id2 is upregulated in two mouse models of breast cancer: one that involves hormone-induction of carcinogenesis and the other involves overexpression of HER2/neu. In contrast, Id1 expression is reduced in both models. These data suggest that Id2 may be a common integrator of oncogenic stimuli in breast and that Id1 may suppress breast carcinogenesis. The goals of this work were to determine, using transgenic mouse models, if Id2 is necessary and sufficient for mammary gland tumorigenesis in mice. If so, this would suggest that Id2 or processes regulated by this transcription factor may serve as useful prognostic markers or therapeutic targets in breast cancer.

DTIC

Breast; Cancer; Carcinogens; Integrators; Mammary Glands; Mice; Proteins; Tumors

20080005609 Northeastern Univ., Boston, MA USA

Development of Novel Technetium-99m-Labeled Steroids as Estrogen-Responsive Breast Cancer Imaging Agents

Hanson, Robert N; Jun 2007; 33 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0544

Report No.(s): AD-A474746; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474746>

The goal of this project was the preparation and evaluation of new technetium-99m labeled compounds via utilization of their rhenium surrogates. An initial series of rhenium tricarbonyl complexes of estradiol were prepared using Stille coupling methods at the 17-alpha position of estradiol. While the compounds were chemically stable and retain modest affinity for the estrogen receptor compared to estradiol (2-10%), their ability to stimulate or inhibit estrogen function in cells was very low. As a result, the synthetic focus shifted to the 11-beta position of estradiol. Initial examples of 11-beta substituted estradiols were prepared which retained high affinity and potent antiestrogenic activity in cells. Newer rhenium tricarbonyl binding groups were also prepared which had the capability of ligation to the steroidal components using Huisgen [3+2] cycloaddition chemistry. The multi-step process for preparing the steroid component did not provide sufficient material at this time to evaluate the effectiveness of the ultimate steroid-metal binding target compounds.

DTIC

Breast; Cancer; Estrogens; Imaging Techniques; Mammary Glands; Pharmacology; Radioactive Isotopes; Steroids; Technetium

20080005614 University of Southern California, Los Angeles, CA USA

Mechanism of Ovarian Epithelial Tumor Predisposition in Individuals Carrying Germline BRCA1 Mutations

Dubeau, Louis; Dec 2006; 56 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0125

Report No.(s): AD-A474752; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474752>

Women with germline mutations in BRCA1 are strongly predisposed to cancers of the ovary and fallopian tubes. Given the strong link between menstrual activity and risk of ovarian cancer in the general population, we hypothesized that BRCA1 might predispose to ovarian cancer indirectly, by influencing ovarian granulosa cells, which play an important role in controlling menstrual cycle progression. We used the Cre-lox system to inactivate the mouse Brca1 gene in granulosa cells. A truncated form of the FSH receptor promoter was used as Cre driver. Our most recent results show that a majority (40 of 59) of mutant mice develop grossly visible cystic tumors either attached to the ovary or the uterine horns. These tumors resembled human serous cystadenomas, which are benign tumors made up of the same cell type as ovarian serous carcinomas. We confirmed that these tumors carried only the wild type allele of the floxed Brca1 allele while the mutant form was present in granulosa cells. These findings strongly support our initial hypothesis that Brca1 influences tumor development cell non-autonomously, through an effector secreted by granulosa cells. We developed tools such as long-term cultures of human granulosa cells, which will be used to compare the gene expression patterns of wild type and mutant granulosa cells in the second year. We also obtained preliminary data suggesting that the dynamics of the hormonal changes associated with the estrous cycle are slightly different in mutant mice, suggesting that the influence of granulosa cells on tumor predisposition in this animal model may be mediated through their role in the ovulatory cycle. Finally, we show evidence that the mutant mice show increased proliferative activity in epithelial cells lining the uterus and endometrium and endometrial glands, strongly supporting our view that ovarian epithelial tumors are derived from components of the mullerian tract.

DTIC

Breast; Cancer; Epithelium; Genes; Hormones; Mammary Glands; Mutations; Ovaries; Tumors

20080005615 Wake Forest Univ., Winston-Salem, NC USA

Breast Cancer Prevention by Inducing Apoptosis in DCIS Using Breast Ductal Lavage

Koty, Patrick P; Sep 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0683

Report No.(s): AD-A474753; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474753>

Current prevention focuses on oral administration of chemopreventive agents which decreases breast cancer incidence but increases the risk for secondary treatment-induced disease and may not be effective in preventing those lesions that are estrogen receptor (ER) negative. We hypothesize that programmed cell death is dysregulated in premalignant breast cells which permits these cells to avoid cell death. Our studies indicate the ductal carcinoma in situ cell line DCIS3A overexpresses the anti-apoptotic proteins Bcl-2 and Bcl-xL compared to normal breast tissue. In addition, we have shown that DCIS3a treated with a bispecific antisense oligonucleotide against bcl-2 and bcl-xl down regulates expression of both proteins. These studies also show an increase in programmed cell death in the DCIS3A cell line after treatment with the bispecific antisense oligo bcl-2/bcl-xl alone but not with tamoxifen alone nor a synergic effect in combination with the antisense oligo. Finally, cells obtained from breast ductal lavage appear to express BCL-2, BCL-XL, and BAX which suggests these cells may be already avoiding programmed cell death.

DTIC

Apoptosis; Breast; Cancer; Mammary Glands; Prevention

20080005616 Roswell Park Memorial Inst., Buffalo, NY USA

Hypoxia and Prx1 in Malignant Progression of Prostate Cancer

Park, Young-Mee; Sep 2007; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0572

Report No.(s): AD-A474756; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474756>

Hypoxia has been proposed to function as a microenvironmental pressure to select for a subset of cancer cells with an increased ability to survive and proliferate. The activation of Nrf2 and the up-regulation of prx1 expression by changes of oxygenation are likely to contribute to the malignant progression of cancer and to modify the treatment response of cancer cells. The information provided in the current study suggests that the Nrf2-Prx1 axis may serve as a fruitful target for cancer

prognosis and therapy. Identifying the key regulatory components and understanding the molecular basis of prx1 gene regulation by Nrf2 are critical to the development of intervention strategies. Future research will be aimed at finding out whether Nrf2-Prx1 activation can be suppressed by genetic and/or pharmacological approaches, and whether suppressing the Nrf2-Prx1 axis will inhibit the malignant progression or reverse treatment resistance in pre-clinical models. We provide the first evidence that suggests hypoxia increases AR function in human prostate cancer cells, and Prx1 enhances the hypoxia-mediated AR activation. Delineating the molecular mechanisms by which hypoxia affects AR function will provide insight into the treatment resistance and malignant progression of prostate cancer cells. Novel therapeutic approaches should be developed to prevent hypoxia and/or its consequences to enhance the efficacy of androgen deprivation therapy, a treatment that has not been improved significantly since its introduction over 50 years ago.

DTIC

Cancer; Hypoxia; Prostate Gland

20080005618 Congressional Budget Office, Washington, DC USA

Restructuring Military Medical Care

B Davidson, Ellen; Chambers, Elizabeth; Jul 1995; 110 pp.; In English

Report No.(s): AD-A474762; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474762>

This paper, prepared at the request of the House Committee on National Security, examines the way in which the military medical system trains for wartime and the extent to which providing peacetime care contributes to that mission. The paper also analyzes the department's ability to offer peacetime health care cost-effectively. A number of alternative ways of performing the wartime mission and providing health care to eligible military beneficiaries are examined in this paper. But in keeping with the Congressional Budget Office's (CBO's) mandate to provide objective analysis, it makes no recommendations.

DTIC

Medical Services; Military Operations; Peacetime

20080005619 Miami Univ., FL USA

Does Skeletal Muscle Mass Influence Breast Cancer? Evaluating Mammary Tumorigenesis and Progression in Genetically Hyper-Muscular Mice

Zimmers, Teresa; Jul 2007; 14 pp.; In English

Contract(s)/Grant(s): W81XWH-O5-1-0424

Report No.(s): AD-A474768; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474768>

Epidemiologic evidence demonstrates that caloric restriction and physical activity independently reduce breast cancer, potentially by decreasing adiposity and insulin resistance. To determine the role of increased skeletal muscle mass on breast cancer, the authors sought to measure rates of chemically induced mammary tumorigenesis and progression in genetically hypermuscular mice, including mice lacking the muscle growth inhibitor myostatin and mice expressing a dominant negative form of the myostatin receptor (MLC-dnActRIIB mice). Mammary cancer was induced by a combination of a tumor promoter, medroxyprogesterone acetate (MPA), and a carcinogen, dimethylbenz-a-anthracene (DMBA). Technical difficulties with the model required them to seek a no-cost extension for one year. Further experience indicated that body composition of the mice affected the pharmacodynamics of drug administration (i.e., MPA and DMBA given in ethanol and oil had different bioavailability in lean, hypermuscular mice versus mice of normal body type, confounding interpretation of the results). Now the authors have switched to a genetic model of mammary cancer which they are breeding into their hypermuscular mice and the results are pending. In the interim, they used genetic and pharmacological inhibition of the myostatin pathway to potentially preserve muscle in the end-stages of cancer, cancer cachexia. Up to 25% of breast cancer deaths may be attributed to muscle wasting from the complex metabolic syndrome induced by the tumor. However, despite increasing normal muscle growth, myostatin inhibition failed to protect mice from cancer cachexia.

DTIC

Angiogenesis; Breast; Cancer; Mammary Glands; Metabolism; Mice; Muscles; Musculoskeletal System; Tumors

20080005621 General Accounting Office, Washington, DC USA

Military Base Realignments and Closures: Impact of Terminating, Relocating, or Outsourcing the Services of the Armed Forces Institute of Pathology

Williamson, Randall B; Avruch, Sheila; Griffin, Adrienne; Hamann, Cathy; Hoban, Nora; Modi, Jasleen; Morgan, Carolina; Wysocki, Andrea; Nov 2007; 60 pp.; In English

Report No.(s): AD-A474772; GAO-08-20; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474772>

Armed Forces Institute of Pathology (AFIP) pathologists perform three key services -- diagnostic consultations, education, and research -- primarily for physicians from DoD, the Department of Veterans Affairs (VA), and civilian institutions. The 2005 Base Realignment and Closure (BRAC) provision required the Department of Defense (DoD) to close the AFIP. GAO was asked to address the status and potential impact of implementing this BRAC provision. This report discusses the following: (1) key services AFIP provides to the military and civilian communities; (2) DoD's plans to terminate, relocate, or outsource services currently provided by AFIP; and (3) the potential impacts of disestablishing AFIP on military and civilian communities. New legislation requires DoD to consider this GAO report as it develops its plan for the reorganization of AFIP. GAO reviewed DoD's plans, analysis, and other relevant information, and interviewed officials from the public and private sectors. GAO recommends DoD report to Congress on the following: (1) its strategies for organizing consultation services, (2) AFIP's tissue specimen repository's assets and their potential use, and (3) its strategies for using the repository. DoD generally concurred with GAO's findings and conclusions. GAO has modified its recommendations to reflect concerns DoD raised about additional steps it needs to take before it can report on its strategies for using the repository. The Department of Veterans Affairs (VA) stated that GAO's report was factually accurate, but believed that it did not sufficiently describe the impact of closing AFIP. GAO believes that this report provides a balanced assessment of AFIP's services and the impact of its closing.

DTIC

Armed Forces; Closures; Management Planning; Pathology; Relocation; Research Facilities

20080005624 British Columbia Cancer Research Centre, Victoria, British Columbia Canada

A Genomic Approach to Identifying Novel Targets for Early Detection and Intervention of Prostate Cancer

Lam, Wan L; Vielkind, Juergen R; Sep 2004; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0028

Report No.(s): AD-A474781; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474781>

Early detection and intervention are key to a favorable prognosis in prostate cancer. Despite advances in the detection and treatment of prostate cancer, the mortality rate remains high. To improve survival, early detection and treatment strategies tailored to pre-invasive prostate cancer are required. The authors propose to catalog genetic alterations associated with the developmental stages of disease for use as diagnostic tools, and to identify the critical genes that drive the transformation of premalignant lesions to tumors for use as molecular targets for novel treatment design. The combination of laser capture microdissection (efficient isolation of specific cell types from hundreds of specimens) and SMAL DNA fingerprinting technology (high-throughput analysis of genomic targets using minute quantities of DNA yielded from the microdissected cells) will facilitate systematic comparison of samples in various stages of disease development. By the end of this work, the authors will have identified a set of genetic loci (and genes) by virtue of their frequency of alteration in premalignant lesions and subsequently in low-grade tumors. They will have established a publicly accessible 'genetic alterations in prostate cancer' database that catalogs somatic changes present in the various stages of cancer progression. This information will contribute to the fundamental understanding of prostate cancer pathogenesis.

DTIC

Cancer; Detection; Genes; Genetics; Genome; Histology; Identifying; Pathogenesis; Pathology; Prostate Gland; Targets

20080005664 Woods Hole Oceanographic Inst., MA USA

Marine Mammal Necropsy: An Introductory Guide for Stranding Responders and Field Biologists

Pugliares, Katie R; Bogomolni, Andrea; Touhey, Kathleen M; Herzig, Sarah M; Harry, Charles T; Moore, Michael J; Sep 2007; 133 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NA05NMF4391165

Report No.(s): AD-A474813; WHOI-2007-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This necropsy manual is designed to establish a base level of proficiency in marine mammal necropsy techniques. It is written for stranding network members who do not have a formal pathobiological training and have limited knowledge of

anatomy. Anatomical and pathological jargon has been kept to a minimum. This manual is divided into six sections: preliminary data, sample management, pinniped, small cetacean, large whale (at sea and on the beach), and multiple appendices (A-H). A well-illustrated, carefully written gross necropsy report is essential to an adequate diagnostic investigation. Gross reports with significant detail and description tend to engender useful histopathological findings. A sample blank gross necropsy report and guidelines in writing a report can be found in Appendices A & B. Overall, this guide aims to lead the enquiring mind through the necessary steps to produce such reports. While this manual focuses on process and interpretation, it is important to understand that the gross necropsy is primarily about making detailed, descriptive observations without bias as to possible etiology. The necropsy should establish a list of differential diagnoses and the sampling be directed by an attempt to discriminate between them.

DTIC

Animals; Histology; Mammals; Marine Biology; Marine Mammals; Pathology; Transponders

20080005681 Oregon Health Sciences Univ., Portland, OR USA

Development of a Novel Vector for Multiple CDC Category a Pathogens

Nelson, Jay A; Wong, Scott W; Jarvis, Michael A; Apr 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0046

Report No.(s): AD-A474859; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Specific Aim 1 was to generate a panel of RhCMV/MPV vectors expressing MPV antigens A29L, A35R, M1R and B6R in either the wild type RhCMV vector, or in a vector lacking MHC immunomodulatory genes. Vectors have been constructed and characterized, and we have subsequently selected one WT RhCMV vector (WTRhCMV/A35R) for immunological characterization in rhesus macaques. Specific Aims 2 and 3 were to establish the pathobiology of WT MPV infection in RMs, and to monitor the immunological consequences of WT MPV infection. To date, six RMs have been experimentally inoculated intrabronchially with MPV Zaire strain. Two with 2×10^7 plaque forming units (PFU) and four with 2×10^5 PFU, to define a lethal dose by this route of infection and to characterize the virus/host interactions.

DTIC

Diseases; Infectious Diseases; Microorganisms; Pathogens

20080005683 Tulane Univ., New Orleans, LA USA

The Human L1 Element Causes DNA Double-Strand Breaks in Breast Cancer

Deininger, Prescott L; Aug 1, 2006; 44 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0523

Report No.(s): AD-A474861; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The source of mutagenesis for the establishment and maintenance of cancer is complex. However, defects in DNA repair genes in the double-strand break repair pathway are cancer predisposing. My lab has characterized a new potentially important source of double-strand breaks (DSBs) in human cells and are interested in characterizing which DNA repair genes act on this particular source of DNA damage. Selfish DNA accounts for 45% of the human genome. We have recently demonstrated that one particular selfish DNA, the L1 retrotransposon, creates DSBs via its endonuclease domain. The important conclusions from the published work are that 1) the human retrotransposon L1 creates DSBs and 2) the DSB repair gene ATM is required for L1 retrotransposition. To additionally characterize the roles of ATM and the ATM-related genes, BRCA1 and BRCA2, in L1-induced DSBs, we developed a new vector system to suppress their expression which is compatible with L1 assays. These constructs should also be of general utility.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Mammary Glands; Strands; Vector Analysis

20080005684 California Univ., San Francisco, CA USA

X Chromosome Inactivation and Breast Cancer: Epigenetic Alteration in Tumor Initiation and Progression

Panning, Barbara; Sep 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0451

Report No.(s): AD-A474862; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We tested whether reactivation of the inactive X chromosome in the mouse mammary gland contributes to tumorigenesis in vivo and whether that reactivation of the inactive X can cooperate with the MYC oncogene in tumor progression. We found no evidence for a role of reactivation of the inactive X in tumor initiation or progression. We also examined whether the inactive X was reactivated in a number of different mouse breast cancers and found not evidence to support reactivation.

Finally, these studies directly lead to an examination of whether the BRCA1 promotes breast cancer by affecting the function of Xist RNA during X-inactivation, and found that Xist RNA and X-inactivation are unaffected in BRCA1 mutant cells and cancers.

DTIC

Breast; Cancer; Chromosomes; Deactivation; In Vivo Methods and Tests; Mammary Glands; Tumors

20080005685 University of Southern Illinois, Springfield, IL USA

The Role of Tumor Metastases Suppressor Gene, Drg-1, in Breast Cancer

Watabe, Kounosuke; Mar 2007; 78 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0309

Report No.(s): AD-A474863; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is the most frequently diagnosed cancer and the second leading cause of cancer death among women in the US. Because metastatic disease is the major cause of death, it is crucial to understand the mechanism by which tumor cells metastasize to the distant organs so that we can identify a better therapeutic target. During this funding period, we found that the metastasis suppressor gene, Drg-1, was capable of down-regulating the ATF3 gene and thus suppressing metastases. We also found that Drg-1 is a good prognostic marker for patient outcome. Our results also suggest that the ATF3 pathway is a potential therapeutic target for patients with metastatic disease. We will focus our next year's effort on further clarification of the Drg-1 pathway and its relation to PTEN.

DTIC

Breast; Cancer; Genes; Mammary Glands; Metastasis; Suppressors; Tumor Suppressor Genes

20080005686 Texas Univ., Houston, TX USA

Epigenetic Silencing and Resistance to Imatinib Mesylate in CML

Issa, Jean-Pierre; Jul 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0448

Report No.(s): AD-A474866; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We performed analyses of DNA methylation data reported in the final report with clinical outcome of CML patients. DNA methylation significantly correlated with survival. CML patients with average methylation zscore values above zero had significantly shorter survival than patients with z-scores below zero (median 10 months vs 59 months, $P < 0.0001$). This was true also within CP (median survival of 44 months for patients with high methylation vs median not reached in patients with low methylation, $P = 0.02$) and AP (median survival of 11 months for patients with high methylation vs 27 months in patients with low methylation, $P = 0.009$). Changes in gene silencing by DNA methylation may play a role in developing alternative routes for cells to circumvent the effects of imatinib.

DTIC

Deoxyribonucleic Acid; Leukemias

20080005688 Iowa Univ., Iowa City, IA USA

PSMA-Targeted Polygadolinium Clusters: A Novel Agent for Imaging Prostate Cancer

Messerle, Louis; Jan 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0155

Report No.(s): AD-A474868; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Controlled hydrolysis of lanthanide element or yttrium salts in the presence of aminoacids yields a series of polynuclear clusters with two, four, twelve, fourteen, and fifteen lanthanide or yttrium centers bridged by hydroxides and possessing chelatingamino acids. The MRI relaxivity of the gadolinium (Gd) clusters has been studied invitro, with an unprecedented, large, pH-dependent value of $165 \text{ mM}^{-1} \text{ s}^{-1}$ for the Gd14cluster. We have crystallized dysprosium (Dy) analogs of the dinuclear and tetranuclearclusters for neutron diffraction analysis in order to determine the dysprosium&hydrogen(hydroxide) distance. Yttrium analogs have been prepared, structurally characterized,and studied by yttrium-89 NMR spectroscopy in order to determine solution structures.The first attempt at preparing a Y15 cluster gave, in the presence of residual carbonate,an unprecedented Y60 polyhedral cluster that suggest routes to larger Gd clusters.Europium (Eu) cluster analogs have been prepared and their reduction explored in orderto exploit the Eu(II)-Eu(III) redox couple and develop a redox-sensitive MRI reporterfor reactive oxygen species in tumors. A potentially multinuclear chelating ligand withamino acid serine moieties at

each end has been prepared by multi-step organic synthesis for ditopic coordination of the Gd14 cluster.

DTIC

Cancer; Imaging Techniques; Prostate Gland

20080005690 Mount Sinai School of Medicine, New York, NY USA

Role of Cdc25C Phosphatases in Human Breast Cancer

Manfredi, James J; May 2006; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0305

Report No.(s): AD-A474870; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A summary is presented of research performed during the first year of a project to determine the role of Cdc25 phosphatases in human breast cancer. Three specific aims are being pursued. The first is to determine the role of Cdc25B in breast cancer proliferation. The second aim is examining whether alternative splicing of Cdc25C contributes to human breast cancer. The final aim is to explore a potential novel breast cancer therapy involving altered expression of Cdc25C. The long term goals of this research is to validate a clear role for Cdc25B in breast tumor cell proliferation and to rigorously determine whether Cdc25C may contribute to human breast tumorigenesis in other ways besides its overexpression.

DTIC

Breast; Cancer; Mammary Glands

20080005702 Pennsylvania State Univ., University Park, PA USA

Microfabricated Multianalyte Sensor Arrays for Metabolic Monitoring

Pishko, Michael V; Sep 1, 2007; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0780

Report No.(s): AD-A474908; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Glucose sensor arrays were fabricated on gold electrodes on flexible polyimide sheets by cross-linking glucose oxidase and redox polymer using UV-initiated free radical reaction. Using conventional silicon fabrication methods, five-element array Au microdisks were initially fabricated using mid-UV photolithography. Active glucose oxidase were entrapped by hydrogel by UV-initiated photo polymerization with poly(ethylene glycol) diacrylate or PEG-DA on the array electrodes. The fabricated microarray sensors were individually addressable and with no cross-talk between adjacent array elements as assessed using cyclic voltammetry. We have fabricated an array of glucose sensors on flexible polyimide sheets that exhibit the desired linear response in the biological range. We have also tested the sensors using other electrochemical methods including amperometry and square wave voltammetry (which is known for its background reduction).

DTIC

Bioinstrumentation; Electrodes; Electromechanical Devices; Metabolism; Oxidation-Reduction Reactions; Polyimide Resins; Polymers

20080005703 La Jolla Inst., CA USA

Adipose Estrogen and Increased Breast Cancer Risk in Obesity: Regulation by Leptin and Insulin

Samad, Fahumiya; Sep 7, 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0497

Report No.(s): AD-A474909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Clinical studies suggest that obesity increases the risk for breast cancer and there is convincing evidence that post-menopausal breast cancer risk is highly correlated with serum estrogen levels. One potential link between obesity and breast cancer risk is increased estrogen production by the adipose tissue itself. Adipose tissue produces the enzyme aromatase, which catalyses the biosynthesis of estrogens from androgens. Adipose tissue also produces 17-beta-hydroxysteroid dehydrogenase (17-beta HSD), which is important for the conversion of estrone to estradiol. Thus, the increased expression of both of these enzymes is important for the production of biologically active estrogen. The investigator's studies have identified two key molecules (insulin and leptin) in obesity that regulate aromatase and 17-beta HSD synthesis in adipose tissues and in adipocytes. The identification of these target molecules that may ultimately induce estrogen production in the setting of obesity may provide a unique therapeutic preventive strategy to reduce systemic estrogen levels and thereby reduce post-menopausal breast cancer risk associated with obesity.

DTIC

Adipose Tissues; Breast; Cancer; Estrogens; Insulin; Mammary Glands; Obesity; Risk

20080005705 Vanderbilt Univ., Nashville, TN USA

Checkpoint Kinase-Dependent Regulation of DNA Repair and Genome Instability in Breast Cancer

Lovejoy, Courtney A; Jun 1, 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0528

Report No.(s): AD-A474916; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DDB1, a component of a Cul4A ubiquitin ligase complex, promotes nucleotide excision repair (NER) and regulates DNA replication. We have investigated the role of human DDB1 in maintaining genome stability. DDB1-depleted cells accumulate DNA double strand breaks in widely dispersed regions throughout the genome and have activated ATM and ATR cell cycle checkpoints. Depletion of Cul4A yields similar phenotypes, indicating that an E3-ligase function of DDB1 is important for genome maintenance. In contrast, depletion of DDB2, XPA, or XPC does not cause activation of DNA damage checkpoints, indicating that defects in NER are not involved. One substrate of DDB1-Cul4A that is crucial for preventing genome instability is Cdt1. DDB1-depleted cells exhibit increased levels of Cdt1 protein and re-replication, despite containing other Cdt1 regulatory mechanisms. Accumulation of DNA damage, re-replication, and activation of checkpoint responses in DDB1-depleted cells requires entry into S-phase and is partially, but not completely, blocked by co-depletion of Cdt1. Therefore, DDB1 prevents DNA lesions from accumulating in replicating human cells, in part, by regulating Cdt1 degradation. Loss of DDB1 function also likely inactivates the other ubiquitin-dependent mechanism of Cdt1 destruction (SCFSkp2), since active checkpoints in DDB1-depleted cells inhibit CDK activity. Thus, our data indicate that DDB1 has at least two unique and essential functions in human cells to maintain genome integrity.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Genome; Mammary Glands; Proteins

20080005706 Dartmouth Coll., Hanover, NH USA

Therapeutic Conversion of Viability Promoting MCL1 to Death-Inducing Forms: A Novel Strategy for Breast Cancer

Craig, Ruth W; Jul 1, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0446

Report No.(s): AD-A474918; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The BCL2 family member MCL1 is expressed in breast cancer cells in its full-length, anti-apoptotic form. The goal of this project was to induce conversion of MCL1 to pro-apoptotic forms as a means of enhancing the death of these cells. The approach was identify means of inducing alternate splicing of MCL1 using antisense oligonucleotides, since splice variants are known to promote cell death rather than cell survival. We identified reagents and conditions that result in decreased expression of the antiapoptotic MCL1L protein and increased expression of proapoptotic splice variants. These splice-switching agents inhibited tumor cell growth, and did so in a more sustained fashion than siRNA directed against MCL1L. Reagents that induce splice switching of MCL1 thus have promise for further development for the treatment of breast cancer.

DTIC

Apoptosis; Breast; Cancer; Death; Mammary Glands; Proteins; Therapy; Viability

20080005715 Virginia Univ., Charlottesville, VA USA

Constrained Adaptive Beamforming for Improved Contrast in Breast Ultrasound

Walker, William F; Jun 1, 2007; 158 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0590

Report No.(s): AD-A474930; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ultrasonic imaging plays an important role as an adjunct to mammography, with an emerging role in breast cancer screening. Ultrasound's real-time nature, lack of ionizing radiation, and relative comfort for the patient make it an attractive imaging choice. Unfortunately ultrasound image quality is often limited. We hypothesize that bright scatterers seriously degrade ultrasound images by introducing image clutter. In the breast bright off-axis echoes may originate from Cooper's ligaments, structured glandular tissue, calcification, fat-soft tissue interfaces, or other structures. We initially proposed using a variant of the Frost Adaptive Beamformer to reduce clutter but discovered that this technique is non-optimal for our application. Extensive literature review led us to modify the Spatial Processing Optimized and Constrained algorithm (SPOC) to yield the Time-Domain Optimized Near-field Estimator (TONE). In simulations and phantom experiments this technique yields dramatic improvements in resolution and contrast. We have also developed alternate methods of image formation (LCLS and QCLS).

DTIC

Beamforming; Breast; Cancer; Mammary Glands; Ultrasonics

20080005721 Scripps Research Inst., La Jolla, CA USA

Inhibition of Mutation: A Novel Approach to Preventing and Treating Cancer

Romesberg, Floyd E; Jun 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0504

Report No.(s): AD-A474940; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this proposal is to identify the proteins in human cells that are responsible for mutagenesis. Specific biochemical pathways are responsible for introducing mutation to the genome. Using drug(s) to inhibit one or more of these proteins and thereby prevent cancer is a novel and unique cancer prevention approach. Using a yeast deletion strain library we developed and implemented high-throughput screens to identify genes involved in mutation. Using this approach we identified all of the genes required for mutation induced by DNA damage resulting from ultraviolet light and methylmethane sulfonate. Most notably the screens identified a novel pathway of induced mutation involving regulation of nucleotide substrates for a replicative DNA polymerase in addition to identifying the known pathways of induced mutation involving the error prone translesion polymerases. Future work will involve further characterization of the novel mutation pathway as well as additional screens using different damage conditions and selections.

DTIC

Breast; Cancer; Damage; Deoxyribonucleic Acid; Mammary Glands; Mutations; Proteins

20080005722 Texas Univ., Dallas, TX USA

Therapeutic Vascular Targeting and Irradiation: Correlation of MRI Tissue Changes at Cellular and Molecular Levels to Optimizing Outcome

Zhao, Dawen; Jun 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0363

Report No.(s): AD-A474941; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Vascular targeting agents (VTA) are able to disrupt tumor vasculature, leading to extensive tumor necrosis. Interesting findings have shown that VTA kills cells predominantly in the more hypoxic tumor center, while the better perfused peripheral rim is less affected. This apparently limits the effectiveness of such agents and rapid regrowth of tumor residues occurs. However, these findings suggest a potential of a combination of VTA with treatments specifically targeting the viable tumor rim. Radiation can certainly be expected to be most effective against the well-perfused and oxygenated cell populations at the peripheries of the tumors. One major goal of this project is to fully understand and precisely assess the dynamic changes in blood perfusion and oxygenation after VTA, so that we may predict response and optimize the therapy. I propose to use in vivo MRI to measure and assess physiological changes, e.g. tumor blood perfusion and dynamic tissue oxygenation, in the tumors before and after treatment. I believe non-invasive MRI approaches may provide a valuable prognostic tool to predict the response of specific breast tumors to VTA.

DTIC

Cancer; Cardiovascular System; Imaging Techniques; Irradiation; Magnetic Resonance; Prostate Gland; Therapy

20080005723 Moffitt (H. Lee) Cancer Research Inst., Tampa, FL USA

Computerized Analysis and Detection of Missed Cancer in Screening Mammogram

Li, Lihua; Apr 2007; 29 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0212

Report No.(s): AD-A474942; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is to explore an innovative CAD strategy for improving early detection of breast cancer in screening mammograms by focusing on computerized analysis and detection of cancers missed by radiologists. It is motivated by the facts that (1) it can be very instructive to review retrospectively the false negative results to determine why cancers were missed in mammographic screening; (2) some preliminary studies showed that there exist distinguishing features of missed cancer which is different from that of detected cancers. Significant progresses were made on data collection and analysis of characteristics of missed cancer in terms of its computational featured; missed cancer analysis with a focus on density analysis and its effect on CAD detection; new CAD system design; evaluation of the stand-alone detection sensitivity/specificity of the new CAD system; evaluation of the improvement of cancer early detection by using new CAD system. The results demonstrated the effectiveness of this study in improving detection performance.

DTIC

Breast; Cancer; Computer Techniques; Diagnosis; Mammary Glands

20080005724 Salk Inst., La Jolla, CA USA

A Novel Strategy for Isolation, Molecular and Functional Characterization of Embryonic Mammary Stem Cells Using Molecular Genetics and Microfluidic Sorting

Wahl, Geoffrey; Jun 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0331

Report No.(s): AD-A474943; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We are developing a genetic system to identify isolate and characterize mammary stem cells. Our system consists of both activator and reporter components. The activator component is dependent both on Wnt signaling which is essential for mammary gland development and on doxycycline to toggle the system on and off. The reporter component labels cells for direct visualization. We used a modular design to enable the system to be applied to cancer models and other organs. Data obtained over the past year with a related proof of concept system showed that mammary glands were brightly labeled by H2BGFP fluorescence in response to the Tet transactivator. This initial evaluation demonstrates the feasibility of the approach in vivo. In vitro analyses showed that chromatin is labeled by H2BGFP regardless of cell cycle phase. The molecular reagents and strategies we are developing have broad applications for studies examining the relationship between normal and cancer stem cells and determining whether they share the same origin.

DTIC

Genetics; Isolation; Mammary Glands; Microfluidic Devices; Proteins; Stem Cells

20080005725 Florida Univ., Gainesville, FL USA

Biochemical Markers of Brain Injury: An Integrated Proteomics-Based Approach

Hayes, Ronald L; Feb 1, 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0066

Report No.(s): AD-A474944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Brain injury poses a major problem to military care. Historically brain injury has accounted for 25% of all combat casualties and is the leading cause of death among wounded soldiers reaching Echelon I medical treatment. Recent experience in Iraq has suggested brain injury may make an even greater contribution to combat casualties. Incidence of brain injury and resultant long-term disabilities caused by traumatic insults and ischemic events is significantly greater in the civilian population. No clinically useful diagnostic tests exist for traumatic or ischemic brain injury to provide physicians with quantifiable neurochemical markers to help determine the seriousness of the injury, the anatomical and cellular pathology of the injury and to guide implementation of appropriate triage and medical management. Study Design: SOW 1 employs integrated proteomics-based technologies to identify specific proteins or peptide fragments in brain released into CSF and/or blood of rats following experimental traumatic brain injury or focal cerebral ischemia. Technologies include mass spectroscopy, 2-D gel electrophoresis, phage display of single chain antibodies and antibody chips. SOW 2 employs antibody chips to determine which proteins or peptide fragments released into CSF following injury are reliably associated with different injury magnitudes and predict changes in histopathological, behavioral and electrophysiological outcome measures. SOW 3 develops ELISA-based assays capable of detecting biomarkers in blood. Relevance: Development of 'objective triage' capabilities for combat medics and/or Echelon I providers would represent a major 'fieldable' breakthrough in the medical management of combat related head trauma.

DTIC

Biochemistry; Brain; Brain Damage; Injuries; Markers; Proteome

20080005726 Case Western Reserve Univ., Cleveland, OH USA

Multimodality CT/SPECT Evaluation of Micelle Drug Carriers for Treatment of Breast Tumors

Weinberg, Brent D; Gao, Jinming; Jul 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0258

Report No.(s): AD-A474945; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Polymer micelles are a nanoparticle drug delivery system that has the potential to improve breast tumor treatment with chemotherapy. These nanoparticles can increase the half-life of incorporated drugs, can target tumors by incorporating tumorspecific ligands, and can be tracked with imaging through the inclusion of a radiolabel. In this study, quantum dots (QD) were incorporated into PEG/PLA micelles. These micelles were then characterized using transmission electron microscopy, dynamic light scattering, and fluorescence spectrophotometry. The quantum dots were found to be successfully incorporated into micelles, where they retained their fluorescent properties. Cancer cell lines were then treated with in vitro to measure cell uptake of QD-containing micelles. Confocal microscopy demonstrated slow and continuous uptake of micelles which accumulated in the cell cytoplasm. Future studies will measure the effects of modifying these micelles through the addition

of a cRGD or other targeting ligand to increase cellular uptake. Furthermore, the last step of this study will be in vivo tracking of QD micelles while monitoring antitumor efficacy with fluorescently labeled Annexin V.

DTIC

Breast; Cancer; Chemotherapy; Mammary Glands; Micelles; Tumors

20080005727 Wayne State Univ., Detroit, MI USA

Chemosensitization of Breast Cancer Cells to Chemotherapeutic Agents by 3,3'-Diindolylmethane (DIM)

Rahman, Wahidur; Aug 2007; 71 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0505

Report No.(s): AD-A474946; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Constitutive activation of Akt or NF- κ B has been reported to play a role in de novo resistance of cancer cells to chemotherapeutic agents, which is a major cause of treatment failure in cancer chemotherapy. Previous studies have shown that 3, 3'-diindolylmethane (DIM), a major in vivo acid-catalyzed condensation product of indole-3-carbinol (I3C), is a potent inducer of apoptosis, inhibitor of tumor angiogenesis and inactivator of Akt/NF- κ B signaling in breast cancer cells. However, little is known regarding the inactivation of Akt/NF- κ B that leads to chemosensitization of breast cancer cells to chemotherapeutic agents such as Taxotere. Therefore, we examined whether the inactivation of Akt/NF- κ B signaling caused by B-DIM could sensitize breast cancer cells to chemotherapeutic agents both in vitro as well as in vivo. MDA-MB-231 cells were simultaneously treated with 15 to 45 μ M B-DIM and 0.5 to 1.0 nM Taxotere for 24 to 72 hours. Cell growth inhibition assay, apoptosis assay, EMSA, and Western blotting were performed. The combination treatment of 30 μ M B-DIM with 1.0 nM Taxotere elicited significantly greater inhibition of cell growth compared with either agent alone. The combination treatment induced greater apoptosis in MDA-MB-231 cells compared with single agents. Moreover, we found that NF- κ B activity was significantly decreased in cells treated with B-DIM and Taxotere. We also have tested our hypothesis using transfection studies followed by combination treatment with B-DIM/Taxotere and found that combination treatment significantly inhibited cell growth and induced apoptosis in MDA-MB-231 breast cancer cells mediated by the inactivation of NF- κ B, a specific target in vitro and in vivo. These results were also supported by animal experiments which clearly showed that BDIM sensitized the breast tumors to Taxotere which resulted in greater anti-tumor activity mediated by the inhibition of Akt and NF- κ B.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Mammary Glands

20080005728 TRUE Research Foundation, San Antonio, TX USA

Contract Support and Facilitation of Epidemic Outbreak Surveillance (EOS) Program Final Operating Capability (FOC)

McCarty, Brian; Lott, Lisa; Aug 2007; 233 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-C-0199

Report No.(s): AD-A474947; No Copyright; Avail.: Defense Technical Information Center (DTIC)

After meeting the Advanced Concept Technology Development (ACTD) original developmental milestone objectives the portable molecular diagnostic (pMD) platform contract with Applied Biosystems (ABI) was terminated when the contractor was unwilling to seek FDA approval. ABI testing up to contract termination is included in this report. The EOS ACTD program initiated a technology review process and pre-validation testing to determine if other technology platforms could be developed in time to meet EOS ACTD objectives. This process has been summarized in a series of notebooks and is included in this report for each potential vendor and technology including a composite Technology Recommendations report. Quarterly scientific meetings were held and the results and conclusions of the meeting presentations are discussed from the final Scientific Advisory Board (SAB) meeting held in Atlanta on July 31 2007. Additionally the Real Time Polymerase Chain Reaction (RT-PCR) testing performed at the Advanced Diagnostic Laboratory during the Lackland AFB Adenovirus type B14 outbreak including public health prevention and control testing strategies concludes the final report.

DTIC

Adenoviruses; Public Health; Surveillance

20080005729 California Univ., Berkeley, CA USA

Parallel Synthesis and Biocatalytic Amplification of Marine-Inspired Libraries: An Integrated Approach Toward Discovering New Chemotherapeutics

Clark, Douglas S; Sep 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0685

Report No.(s): AD-A474948; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We have made further progress toward preparing lead compounds for new anticancer drugs from a novel class of starting

materials containing the cyclopentenone scaffold. Two diastereomeric natural-product IL-6 inhibitors, madindolines A or B, were also prepared via an exceptionally efficient synthesis. The new cyclopentenones comprise a library of complex, polyfunctional organic molecules of unprecedented structure. The most important class of enzymes for biocatalytic amplification of these compounds is the cytochrome P450s. We have developed and optimized new reaction systems (e.g., surfactant-stabilized two-phase emulsions) that will expand the synthetic utility of cytochrome P450s and render them much more effective catalysts for structural elaboration of the chemically synthesized compounds. We also used a novel 3D cell-culture chip to screen cyclopentenone libraries for inhibitory activity toward cytochrome P450s and for cytotoxicity against cancerous breast cells. The toxicities of select cyclopentenones were investigated further by screening against both cancerous and normal breast cells. These screens revealed structural differences in the cyclopentenones responsible for variations in their toxicity toward cancerous cells, and for greater toxicity toward normal versus cancerous cells. Combining combinatorial synthesis with biocatalytic amplification of chemical libraries is a new approach to drug discovery, which we are applying to a promising but largely unexplored class of compounds.

DTIC

Amplification; Chemotherapy; Drugs; Exploration

20080005730 Dana Farber Cancer Inst., Boston, MA USA

Does Combination Immunotherapy with Human Monoclonal Antibodies Against HER2 and CXCR4 Augment Breast Cancer Killing in Vitro and in Vivo

Marasco, Wayne A; Aug 2007; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474949; W81XWH-05-1-0417; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The chemokine receptor CXCR4 and its ligand CXCL12 (SDF1) have been proposed to regulate the directional migration and invasion of breast cancer cells to sites of metastases. The CXCR4 molecule could be a potential target to control breast cancer. Human epidermal growth factor receptor-2 (HER2) overexpression contributes to tumor progression and metastasis. A humanized monoclonal antibody Herceptin(Trastuzumab) is currently in clinical use. Thus, both of CXCR4 and HER2 play important roles in breast cancer progress, the linkage between CXCR4 and HER2 has also been reported. HER2 upregulates the expression of CXCR4, which is required for HER2- mediated lung invasion and metastasis. Therefore, we aimed to assess the anti-tumor effects of combinational immunotherapy by targeting both CXCR4 and HER2 in vitro and in a nude mouse breast cancer model. We have produced enough antibodies for the entire study, and established the CXCR4 expressing cell lines for both in vitro and in vivo studies. We have evaluated the effects of anti- CXCR4 Mabs in combination of Herceptin oralone on inhibition of chemotaxis, invasion and proliferation on breast cancer cells. We also tested the function of two anti-CXCR4 Mabs in animal model. To data, we have not been able to demonstrate anti-tumor activities of our anti-CXCR4 MABs in vitro or in vivo which we believe are, at least in part, due to technical problems with our assays and low expression of CXCR4 on the tumor cells used for in vivo assays. We are continuing to address these issues so we can answer the questions we have proposed in the future.

DTIC

Antibodies; Breast; Cancer; In Vitro Methods and Tests; In Vivo Methods and Tests; Mammary Glands

20080005817 Air War Coll., Maxwell AFB, AL USA

The Air Force 'In Silico' -- Computational Biology in 2025

Coates, Christopher; Nov 2007; 49 pp.; In English

Report No.(s): AD-A474845; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The biological sciences have recently experienced remarkable advances and there are now frequent claims that 'we are on the advent of being able to model or simulate biological systems to the smallest, molecular detail.' Such a capability, the product of a science known as computational biology, could radically change the health and life sciences and may have enormous impact in many fields, including military operations. This study addresses the questions of whether or not computational biology will be able to simulate biological systems by 2025, and what the implications are for the USA Air Force (USAF). An examination of current capabilities and limitations leads to a prediction that computational biology is unlikely to be 'mature' by 2025. Nevertheless, the USAF stands to benefit, even though its application will be limited to certain well understood models. Successful computational solutions are more likely to be found to biological and health problems that exhibit certain identified characteristics. A risk analysis and recommendations for USAF involvement are provided, based on likely progress of computational biology over the next 15-20 years.

DTIC

Computerized Simulation; Military Technology; Molecular Dynamics; Research and Development

20080005820 Air War Coll., Maxwell AFB, AL USA

Biofuels: An Alternative to U.S. Air Force Petroleum Fuel Dependency

Danigole, Mark S; Dec 2007; 60 pp.; In English

Report No.(s): AD-A474843; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA Air Force (USAF) is the largest energy consumer in the Department of Defense (DoD). Volatile oil prices force the USAF to divert money from training budgets and weapon system procurement accounts to cover increased costs due to unbudgeted fuel expenses. In conjunction with the President's mandate to reduce dependency on foreign procured oil and in an effort to stem unfunded fuel expenses, the USAF established an active alternative energy program focused on increased conservation and the development of new, domestic sources of fuel. This paper will examine biologically produced fuel alternatives and their ability to meet USAF jet fuel requirements by the year 2025. This paper examines ethanol, terrestrial produced biodiesel, algae oil, and biobutanol and each fuel's ability to meet JP-8 fuel standards while achieving compatibility with USAF aircraft and fuel distribution systems. Finally, the paper concludes with recommendations that support the continued development of biofuel technology to reduce USAF dependency on foreign procured oil.

DTIC

Bioconversion; Biomass Energy Production; Crude Oil; Diesel Fuels; Energy Conservation; Fuel Oils; Jet Engine Fuels

20080006074 Arizona Univ., Tucson, AZ USA

Hyaluronan-CD44 Interactions Decrease the Metastatic Potential of Breast Cancer Cells

Lopez, Jose I; Jun 1, 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0455

Report No.(s): AD-A474955; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474955>

The adhesion receptor CD44 is known to decrease the metastatic potential of breast cancer cells in vivo. This study focuses on understanding the mechanisms by which CD44 inhibits breast cancer cell invasion. We have found that the interaction between CD44 and Hyaluronan leads to decreased phosphorylation of FAK. Additionally, this interaction also leads to decreased transcription of the metalloprotease MMP9. Together, these mechanisms provide significant insight into how CD44 inhibits the movement of breast cancer cells away from their primary site.

DTIC

Breast; Cancer; Mammary Glands; Metastasis; Phosphorylation

20080006083 Science Applications International Corp., Falls Church, VA USA

Serum Dioxin and Memory Among Veterans of Operation Ranch Hand

Patches, Johnson; Cary, Martin; Grubbs, William; Jackson, William; Robinson, Julie; Pavuk, Marian; Sep 2007; 19 pp.; In English

Contract(s)/Grant(s): F41624-01-C-1012; Proj-2767

Report No.(s): AD-A474965; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474965>

The authors used the Wechsler Memory Scale and the Wechsler Memory Scale-Revised to assess memory among Air Force veterans exposed to Agent Orange and its contaminant, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin), during the Vietnam War. The index subjects were veterans of Operation Ranch Hand, the unit responsible for aerial herbicide spraying in Vietnam from 1962 to 1971. A comparison group of other Air Force veterans who served in Southeast Asia during the same period but were not involved with spraying herbicides, served as referents. Memory was assessed during Air Force Health Study examinations in 1982 and 2002 and dioxin levels were measured in 1987, 1992, 1997, or 2002. The authors assigned each Ranch Hand veteran to the background, low, or high dioxin exposure category on the basis of a measurement of dioxin body burden. Although they found that the immediate recall portion of the Logical Memory subtest of the Wechsler Memory Scale was decreased among veterans with the highest dioxin exposure in 1982, the results of the study indicate that Agent Orange-exposed Ranch Hand veterans were functioning normally with regards to immediate and delayed memory in 2002. No relation between dioxin exposure and change in memory function between 1982 and 2002 was observed. There does not appear to be any long-term adverse effect with regard to memory functioning. The specific neurological mechanisms (e.g., structural, neurochemical, or other) related to the cause of the 1982 deficits in memory are unknown; however, these changes likely have been reversed.

DTIC

Herbicides; Psychophysiology; Serums

20080006091 Alabama Univ., Birmingham, AL USA

Treatment of Primary and Metastatic Breast Cancer by an Armed Replicating Adenoviral Vector

Douglas, Joanne T; Oct 31, 2005; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0256

Report No.(s): AD-A474977; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474977>

In this Exploration Award, we were testing the concept that an oncolytic adenovirus armed with the osteoprotegerin (OPG) gene would be able to eradicate a primary breast cancer tumor by oncolysis, and that secretion of OPG from the infected and lysed cells into the systemic circulation would inhibit osteolytic bone metastases of the breast cancer. We have constructed a replication-defective adenoviral vector expressing human OPG fused with the Fc domain of human IgG, and have evaluated the efficacy of the armed replicating adenoviral vector in vitro. We have demonstrated that sCAR-ligand fusion proteins targeted to CEA, erbB-2 and the EGFR can mediate CAR-independent adenoviral infection of MDA-MB-231 breast cancer cells. These studies provided preliminary data for a funded NIH R01 grant to develop an armed replicating adenovirus for the treatment of bone metastases of breast cancer. To this end, we hypothesize that a replication-selective adenovirus armed with OPG would eradicate bone metastases of breast cancer both directly, by oncolysis, and indirectly, by inhibiting osteoclastic bone resorption and thus reducing the tumor burden.

DTIC

Adenoviruses; Breast; Cancer; Chemotherapy; Drugs; Metastasis

20080006092 Miami Univ., FL USA

Drug Development and Conservation of Biodiversity in West and Central Africa: Performance of Neurochemical and Radio Receptor Assays of Plant Extracts Drug Discovery for the Central Nervous System

Efange, Simon; Mash, Deborah C; Sep 1, 2004; 34 pp.; In English

Contract(s)/Grant(s): DAMD17-99-2-9043

Report No.(s): AD-A474982; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474982>

The thrust of the CNS assay panel was to identify plant extracts that display moderate to high affinity for selected molecular targets. Target selection was based identifying active plant extracts that would be useful for one or more neuropsychiatric disorders. We completed a screen for 102 samples belonging to 43 plants. 41 showed activity at one or more CNS targets. Phytochemical studies have been initiated on several active extracts. A total of 12 plants samples which have tested positive for antiplasmodial activity were collected in bulk quantities for detailed phytochemical investigations into antimalarial and trypanocidal activity.

DTIC

Assaying; Biological Diversity; Central Nervous System; Conservation; Drugs

20080006093 Kimmel (Sidney) Cancer Center, San Diego, CA USA

New Drugs for CML

Deisseroth, Albert B; Feb 1, 2007; 26 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0232

Report No.(s): AD-A474983; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474983>

The goal of the experiments was to test if the acetylenes could be used to suppress the in vivo growth of P210Bcr-Abl dependent cell lines. The work completed during the funding showed that the acetylene compound K1P which had been shown to suppress the in vitro growth of CML cells which are resistant to imatinib and to inhibit p210Bcr-Abl dependent in vitro CML cell growth at the nanomolar concentrations when combined with imatinib could also suppress the in vivo growth of a P210Bcr-Abl dependent cell line (Baf-1P210Bcr-Abl). These studies also showed that the medium in which the drugs were dissolved must contain 0.1% ethanol to increase the solubility sufficiently to suppress in vivo P210Bcr-Abl dependent cell growth. Finally the presence of serum in the medium used to expose the drugs to the P210Bcr-Abl dependent cells blocked the suppressive activity of the drugs despite the presence of 0.1% ethanol. These data suggested that chemical functionalities which could improve the bioavailability of the drugs in the presence of serum needed to be added to the ester side chain of the acetylene compounds. This work once completed will enable further in vivo toxicity and efficacy studies to proceed.

DTIC

Breast; Cancer; Drugs; Mammary Glands; Proteins

20080006095 Mount Sinai School of Medicine, New York, NY USA

Phase I Trial of Adenovirus-Mediated IL-12 Gene Transduction in Patients with Recurrent Locally Advanced Prostate Cancer Following Therapy

Hall, Simon J; Oct 1, 2005; 29 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0249

Report No.(s): AD-A474987; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474987>

Patients with radiorecurrent prostate cancer have few options. Gene therapy may define a treatment option of both local and systemic value. Pre-clinical studies using adenovirus-mediated (Ad.) transduction of IL-12 (Ad.mIL-12) in a metastatic model of prostate cancer resulted in local growth suppression, survival enhancement and inhibition of pre-established metastases. The basis for these activities include the induction of both innate (neutrophils & NKs) and acquired immunity (T cells). On the basis of these results, we propose to explore the use of Ad.hIL-12 in patients with clinically localized radiorecurrent prostate cancer in a Phase I trial to explore the safety, induction of immune responses and efficacy following therapy. Specific Aims/Study Design: In Aim 1 patients will be placed in escalating dose cohorts with the primary endpoint of the maximum tolerated dose as determined by physical examination, laboratory values of bodily functions and evidence of IL-12 gene transduction by measurement of serum by ELISA. In Aim 2 additional safety data will be recorded through measurement of serum levels of the pro-inflammatory cytokines, TNF- α , IFN- γ and IL-16 by ELISA. In Aim 3 peripheral blood mononuclear cells (PBMCs) will be screened for the induction of T cells, which target the prostate antigens, PSA and PAP via an ELISPOT assay.

DTIC

Adenoviruses; Cancer; Genetics; Patients; Prostate Gland; Therapy; Transferring

20080006118 Texas Tech Univ. Health Sciences Center, Lubbock, TX USA

Filling in the Gap in Galectin-1 Export

Rao, Subrahmanyeswara U; Sep 1, 2007; 17 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0544

Report No.(s): AD-A475020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475020>

Many of the eukaryotic secreted proteins generally contain a leader- or export sequence, which directs their synthesis to the endoplasmic reticulum (ER). The secreted proteins are cotranslationally inserted into the ER lumen and are then trafficked to the Golgi and transport vesicles, which fuse with the plasma membrane to release their content to the extracellular space. Interestingly, galectins, fibroblast growth factor (FGF) 1 and 2 (1), interleukin (IL) 1b (2), the human immunodeficiency virus-1 (HIV-1) transactivating protein TAT (3) and the Herpes virus structural protein VP22 (4) are examples of proteins that do not contain leader sequence. While the mechanism of secretion of proteins lacking signal sequence is unknown, IL-1b, FGF-1 and FGF-2 appears to utilize shedding of membrane as vesicles as modules in their secretion (5). HIV-1 TAT, however, seems to be transported directly across the plasma membrane. However, the mechanism by which galectin-1 is secreted is unknown, which is described non-conventional.

DTIC

Cancer; International Trade

20080006133 Industrial Coll. of the Armed Forces, Washington, DC USA

Biotechnology Industry

Campbell, Kyle D; Clemen, Gene; Denham, Paul; Dodson, Greg; Flanagan, Denise; Goble, Dale; Mahon, Deirdre; Martin, Joanne; Merrill, Rick; Milford, Mike; Jan 2007; 31 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475052>

Biotechnology is a diverse and promising industry, but it is not without challenges. The impact on our lives is already being felt, and all indications point to a future of unprecedented changes. Genetically modified (GM) organisms are being used to increase crop production, bacteria to remediate contaminated areas, and even fetal calf skin to grow human soft tissues. Concurrently our nation is seeking biotechnology answers for a variety of national security issues, including the defense of biological or chemical attack and pandemic influenzas. Biotechnology is rapidly impacting multiple industries including medicine, defense, energy, and agriculture. This paper addresses four general biotechnology areas: medical, emerging technology, biodefense, and agriculture. These discussions range from personalized medicine, pandemics and vaccines to biofuels and Project BioShield. The potential economic impact of the industry is tremendous and leads directly to many of

the challenges our nation will face in the future. These challenges include globalization, government regulation, ethical concerns and societal acceptance. As the biotechnology industry continues to mature, we expect to see a bright future where the benefits of biotechnology will outweigh the risks involved in its application.

DTIC

Biotechnology; Industries; Technology Assessment

20080006136 Mystic Aquarium and Inst. for Exploration, Mystic, CT USA

Investigation of Neural-Immune Profiling, Transcriptomics and Proteomics and Clinical Tools in Assessing Navy Dolphin Health

Romano, Tracy; Dec 21, 2007; 8 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0297

Report No.(s): AD-A475058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475058>

The USA Navy maintains and employs approximately 70 bottlenose dolphins (*Tursiops truncatus*), and 25 sea lions (*Zalophus californianus*). These marine mammals are deployed all over the world and are specially trained to carry out specific missions and to provide Fleet support for the U.S. Navy. Given the value of these animals to the U.S. Navy, health maintenance and disease prevention for these animals are vital to the U.S. Navy Marine Mammal Program's (NMMP) mission and focus. In order to maintain health and disease prevention in these animals it is critical to have the tools to assess health status before, during and after deployment as well as assess efficacy of preventative measures such as vaccines and immunostimulants. This proposal represents the continued development and initial evaluation of three merging technologies that have been focused on advancing our understanding of marine mammal health and disease. These technologies include immune profiling with the advent of dolphin-specific reagents and assays, functional genomics utilizing a dolphin microarray and proteomics. These technologies will continued to be developed, and the technologies will be applied to a subset of archived dolphin samples including both healthy and ill dolphins. Results from these technologies will be analyzed in conjunction with available clinical data to evaluate the potential in determining and assessing dolphin health.

DTIC

Dolphins; Health; Immunity; Navy; Proteome

20080006138 Industrial Coll. of the Armed Forces, Washington, DC USA

Health Care Industry

Allen, Roosevelt; Black, Michael; Bray, William; Butt, Douglas W; Calhoun, Bradley; Curran, Sylvia; Garay, Roger; Kelly, Sally; Lieb, Jeffrey C; Litherland, Kimberly; Jan 2007; 34 pp.; In English

Report No.(s): AD-A475080; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475080>

Although the overwhelming majority of Americans claim they are satisfied with the quality of health care they as individuals receive, many nevertheless believe the U.S. health care industry suffers from major problems. Reining in the growing costs of health care entitlements, ensuring access for the millions of Americans who are uninsured, slowing the increase of chronic illnesses, dealing with workforce shortages in key specialty areas, combating the spread of infectious diseases, and improving the effectiveness of the federal government's hospital and public health preparedness programs are major challenges facing our nation over the next 10 years. Policymakers must develop a strategy to deal with the issues of access and cost while maintaining America's excellence in research, innovation, medical education, and responsiveness (hallmarks of the U.S. health care system). Accessible, quality health care is essential for a productive workforce. Therefore, failing to solve the issues facing the industry will have strategic implications for the nation's security and economic prosperity.

DTIC

Health; Industries; Management Systems; Medical Services

20080006148 Mayo Clinic, Scottsdale, AZ USA

Immunotherapeutic Strategies in Breast Cancer: Preclinical and Clinical Trials

Gendler, Sandra J; Sep 14, 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-01-1-0318

Report No.(s): AD-A475107; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475107>

This project is focused on novel tumor vaccines directed at MUC1 and other tumor antigens. Our specific aims are: 1)To

assess the effectiveness of vaccines against MUC1 and other tumor antigens in the prevention and treatment of spontaneous breast carcinomas in mice; 2) To translate an effective vaccine strategy into a phase I clinical trial in patients with undetectable disease following standard therapy. The model of spontaneous mammary cancer is the MUC1-expressing polyoma middle T antigen mice (MMT). We have tested five vaccines in the preclinical mouse model and all elicited a strong immune response. The vaccine using MUC1 class I binding peptides prevented MUC1-expressing tumor growth. We have designed the Phase I clinical trial using a peptide vaccine comprised of MUC1 and HER-2/neu MHC class I peptides and HER-2/neu MHC class II peptide with unmethylated CpG oligodeoxynucleotides and GM-CSF as adjuvants in breast cancer patients free of disease. The clinical trial was unanimously approved by the Mayo Institutional Review Board (IRB 582-05) following receipt of FDA approval (BB-IND 12155) and by the DoD HSRRB in January 2007. Following receipt of the approvals, we encountered difficulties in obtaining the CpG adjuvant, as Coley Pharmaceuticals had licensed the CpG program in oncology to Pfizer during this time. Pfizer Inc. have subsequently agreed to supply this reagent. Amended documents showing the change in supplier of CpG have been submitted to the DoD HSRRB for final approval and to the FDA. Final approval from the Mayo Clinic IRB was received August 2, 2007. The clinical trial will open once all approvals have been received.

DTIC

Breast; Cancer; Mammary Glands; Vaccines

20080006271 Loma Linda Veterans Association for Research and Education, Redlands, CA USA

Molecular Genetic Studies of Bone Mechanical Strain and of Pedigrees with Very High Bone Density

Mohan, Subburaman; Nov 2007; 41 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0744

Report No.(s): AD-A475118; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary goal of the proposed work on bone mechanical strain focuses on identifying the genes and their functions involved in mediating the anabolic skeletal response to mechanical stress. Two hypotheses have been proposed: 1) Quantitative trait loci analysis using the four point bending technique in two strains of mice exhibiting extreme differences in loading response will lead to identification of chromosomal locations of genes involved in variation in skeletal response to mechanical loading. 2) Application of microarray and tyrosine phosphorylation studies using bone cells derived from inbred strains of mice exhibiting extreme differences to loading response and physiologically relevant fluid flow shear strain will lead to identification of key signaling genes and their pathways that contribute to variation in bone cell response to mechanical strain. During the last funding period we proposed several specific objectives for each of the above-mentioned hypothesis. We have made considerable progress in accomplishing all of the specific objectives. Our work during this reporting period has resulted in one published manuscript and two abstracts. We believe that successful accomplishment of the proposed studies will provide a better understanding of the molecular mechanisms involved in identifying the genes and their function as related to mechanical stress.

DTIC

Bone Mineral Content; Bones; Genetics

20080006272 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA

Mechanisms of Chemoresistance in Breast Cancer Cells

Gouaze, Valerie; Aug 2007; 10 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0491

Report No.(s): AD-A475119; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The hypothesis of this study is that glucosylceramide synthase (GCS)-governed drug resistance can be acquired through exposure to ceramide-generating anticancer agents (e.g., Adriamycin, paclitaxel, and etoposide). We have shown that paclitaxel, Adriamycin, and SDZ PSC 833 induce ceramide generation in MCF-7 cells (200, 83, and 900%, respectively, at 24h). Paclitaxel and SDZ PSC 833 increased ceramide levels by 192 and 460%, respectively, at 24h in MDA-MB-231 cells. The ceramide generated by Paclitaxel and SDZ PSC 833 is metabolized to glucosylceramide (GC) (54 and 200%, respectively, in MCF7 cells at 24h; 172 and 307%, respectively, at 24h in MDA-MB-231 cells). When wild-type breast cancer cells such as MCF-7 and MDA-MB-231 are exposed to a low concentration of [¹⁴C]C6-ceramide (0.2 g/ml), cells converted it to sphingomyelin. However, when breast cancer cells are challenged with a higher concentration of [¹⁴C]C6-ceramide (5 g/ml), ceramide was glucosylated to GC via GCS. Acute exposure of MCF-7 and MDA-MB-231 cells to C8-GC (10 g/ml) for 72h increased MDR1 expression by 2- and 4-fold, respectively. Chronic exposure of MDA-MB-231 cells to C8-ceramide for extended periods induced a dramatic increase in MDR1 mRNA levels, and also elicited expression of P-glycoprotein. High passage C8-ceramide-grown MDA-MB-231 cells were more resistant to Adriamycin and paclitaxel. These experiments show that high levels of ceramide enhance expression of the MDA phenotype in cancer cells through what we propose is a GC

intermediate. We then studied another major avenue of ceramide elimination, hydrolysis via ceramidase (CDase). In MCF-7NP (etoposide resistant) and MCF-7/CDDP (cisplatin resistant) compared to MCF-7 cells, alkaline CDase increased by 2- and 34old, respectively, and in MCF-7/AdrR cells, neutral CDase increased by 3.4-fold. This result suggests that CDase could be implicated also in the drug-resistant phenotype.

DTIC

Breast; Cancer; Mammary Glands

20080006273 Baylor Coll. of Medicine, Houston, TX USA

Potent Oncolytic Herpes Simplex Virus for the Therapy of Advanced Prostate Cancer

Zhang, Xiaoliu; Jul 2007; 21 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0437

Report No.(s): AD-A475120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Currently there is no cure for prostate cancer once the disease has spread beyond the gland. As a large percentage of patients have advanced disease at the time of diagnosis or after the conventional therapy fails, new treatment strategies are urgently needed. We proposed to develop a novel virotherapy for prostate cancer during the funding period. Our working hypothesis was that a fusogenic oncolytic virus would induce a widespread syncytia formation (cell- membrane fusion) in tumor tissues, thus significantly enhancing the antitumor effect. We proposed three tasks to test verify this hypothesis. Task 1 is to initially establish a metastatic prostate cancer model in mice and then to test the potency of antitumor effect of the fusogenic oncolytic HSV. Task 2 is to directly compare the fusogenic oncolytic HSV with a conventional one in vivo for their toxicity. Task 3 is to determine if cell based carriers could function as a delivery vehicle for systemic delivery of the fusogenic oncolytic HSV. Overall these tasks have been largely achieved during the funding period. Specifically, we have demonstrated that the fusogenic oncolytic HSV has a potent antitumor activity against established prostate cancer even after systemic delivery. Additionally, the oncolytic virus also showed an effective therapeutic effect against metastatic prostate cancer, while showing very little toxicity to the experimental animals. The extension of this studies demonstrates that co-administration of fusogenic virotherapy with cyclophosphamide, an approved anticancer chemotherapy drug that also has immunosuppressive activities, can significantly increase the therapeutic effect of virotherapy, possibly by inhibiting the host's innate antiviral activities. These encouraging preclinical results have promoted us to plan for a phase clinical trial of using one of the fusogenic oncolytic HSVs to treat solid tumors including prostate cancer.

DTIC

Cancer; Prostate Gland; Therapy; Viruses

20080006274 Vanderbilt Univ., Nashville, TN USA

Identify the Impact of TGF-Beta Signaling on the Stroma in the Progression of Prostate Cancer

Bhowmick, Neil A; Mar 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0046

Report No.(s): AD-A475121; No Copyright; Avail.: Defense Technical Information Center (DTIC)

As a result of androgen ablation TGF- 1 expression levels transiently elevate and regression of benign prostate hyperplasia as well as prostate cancer cells for the most part occur. Better understanding of prostate androgen responsiveness is critical in understanding and ultimately combating androgen-non-responsive prostate cancer. Studying the conditional TGF- type II receptor fibroblast knock out mouse model we developed (Tgfr2fspko), we found that TGF- signaling in the prostate stromal fibroblasts regulate both stromal and epithelial differentiation in the prostate. Notably the data dispels previous reports that TGF- signaling is required for myofibroblast differentiation. As proposed we attempted to develop mice that are stromally knocked out for TGF- signaling and express the large T antigen in the prostate epithelia, but was unsuccessful. We have however acquired techniques in our laboratory to perform tissue recombination experiments where the identical cell types (prostate stroma and epithelia) can generate prostate glands through xenografting, that display similar phenotypic characteristics of intact mice. We hope to gain permission to progress with these experiments in order to address the mechanism of stromal TGF- signaling impact on prostate cancer androgen responsiveness.

DTIC

Cancer; Prostate Gland

20080006275 Pennsylvania Univ., Philadelphia, PA USA

Targeting Tie2 to Increase Breast Cancer Responsiveness to Antiangiogenic Therapy

Lee, William; Jun 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0361

Report No.(s): AD-A475122; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Antiangiogenic therapy of cancers targets tumor blood vessels to deprive malignant cells of oxygen and nutrients. Therapy of human cancers has produced poorer results than therapy of mouse tumors, a disparity that may be explained by more extensive coverage of human tumor vessels (e.g. in breast cancers) by pericytes, which may be rendering vessels more therapy-resistant. Mouse mammary tumor virus (MMTV)- induced mammary carcinomas reproduce the extensive pericyte coverage of tumor vessels seen in human breast cancers and are relatively refractory to antiangiogenic therapy compared to other mouse tumors. This project attempts to decrease pericyte coverage of vessels in these and other tumors by manipulating activity of endothelial cell (EC) Tie2 receptors and improve tumor response to antiangiogenic therapy. We created K1735 tumors and transgenic mice that inducibly express Tie2Ex, an inhibitor of EC Tie2 activation, under doxycycline regulation. Dox-induced Tie2Ex expression in K1735 tumors reduces tumor vessel phospho-AKT and pericyte coverage and causes tumor EC death, vessel regression and tumor stasis. Using Tie2Ex to treat tumors in combination with an antiangiogenic agent, sorafenib, that reduces tumor vessel phospho-ERK expression displayed synergistic effectiveness. We created double transgenic mice that express Tie2Ex in mammary tissue under Dox regulation and are awaiting development of mammary carcinomas in these mice to study the effect of Tie2 inhibition in mammary tumors. We obtained a no-cost extension to finish this project.

DTIC

Angiogenesis; Blood Vessels; Breast; Cancer; Mammary Glands; Neoplasms; Therapy

20080006276 Chicago Univ., Chicago, IL USA

A Chemical Strategy to Trap and Identify Proteins That May Regulate Promoter Hypermethylation in Breast Cancer

He, Chuan; Jul 2007; 15 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0609

Report No.(s): AD-A475123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the support from this grant we have been developing photocross-linking DNA base analogues to trap and identify DNMTs and interacting proteins on specific promoter DNA. To this end Diazirine photophore was introduced into either the major or minor groove of DNA as a photocross linking group via a convertible nucleoside methodology. The resulting DNA probes efficiently cross linked with the E. coli DNA adenine methyltransferase (EcoDam). The diazirine photophore possesses clear advantages over other photocross linking groups previously installed on DNA in that it has the least steric hindrance and efficiently generates a carbene intermediate that non-specifically cross links with protein residues nearby in high efficiency. We have also applied the method to human cell extracts and obtained very promising results. Based on this early success we are working on the BRCA1 promoter DNA and hope to identify the DNMT that works on this promoter in the near future.

DTIC

Breast; Cancer; Mammary Glands; Methylation; Proteins

20080006277 Maryland Univ., Baltimore, MD USA

Baltimore City Faith-Based Prostate Cancer Prevention and Control Coalition

Plowden, Keith O; Feb 2007; 46 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0297

Report No.(s): AD-A475124; No Copyright; Avail.: Defense Technical Information Center (DTIC)

African American men are disproportionately affected by prostate cancer. In order to positively impact this disease early interventions that encourage early detection and treatment are essential. The primary purpose of this study is to test an investigator developed community-based intervention that explores the impact of peer-outreach workers on prostate cancer knowledge perceived benefit and barriers and overall screening behavior. The target sample for this study will be Black men over age 40 who have never participated in prostate cancer screening. Achievement of this objective will result in an increase in prostate cancer knowledge an increase in perceived benefit prostate cancer screening and treatment; a decrease in perceived barrier to screening and an increase in screening among men in the intervention group.

DTIC

Africa; Cancer; Health; Prevention; Prostate Gland

20080006278 Wisconsin Univ., Madison, WI USA

Delphinidin: A Novel Agent for Inhibition of Breast Tumor Kinase Signaling by Targeting EGFR

Afaq, Farrukh; Aug 2007; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0511

Report No.(s): AD-A475125; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Epidermal growth factor receptor (EGFR) is expressed at high levels in at least 25% of breast cancers and is associated with poor prognosis. Upon epidermal growth factor (EGF)-stimulation breast tumor kinase (Brk) is recruited to the EGFR and this event activates the catalytic activity of Brk which in turn phosphorylates paxillin a binding partner and substrate for Brk. The phosphorylation of paxillin promotes the activation of Rac1 thereby stimulating cell migration and invasion in response to EGF. Many synthetic inhibitors of EGFR are known but their use is limited because of their unacceptable cytotoxic effects on normal cells. Therefore identification of a natural nontoxic agent(s) as an inhibitor of EGFR is of utmost importance. Delphinidin a major anthocyanin known to be present in pigmented fruits and vegetables inhibits constitutive and EGF-induced phosphorylation of EGFR activation of PI3K phosphorylation of AKT and MAPK. We also found that delphinidin treatment inhibits constitutive and EGF-induced activation of Brk signaling mediated through EGFR. Furthermore treatment of breast cancer cells with delphinidin inhibited cell growth and invasion and induced apoptosis. Taken together the composite result suggest that delphinidin is an effective inhibitor of EGFR signaling at least in breast cancer cells that act through novel Brk signaling pathway and holds great promise for its treatment.

DTIC

Breast; Cancer; Enzyme Activity; Mammary Glands; Neoplasms; Tumors

20080006279 Johns Hopkins Univ., Baltimore, MD USA

Pilot Comparison of Stromal Gene Expression Among Normal Prostate Tissues and Primary Prostate Cancer Tissues in White and Black Men

Bova, G S; Sep 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0817

Report No.(s): AD-A475126; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This hypothesis development project tested the feasibility of identification, laser capture microdissection, and expression analysis of prostate-stroma specific cells in normal and cancerous prostates, and aims to develop preliminary data sufficient to identify potential differences in stromal RNA expression in normal and cancerous prostate tissue. Our studies found that it is difficult but not impossible to histologically identify prostate zones with an acceptable degree of confidence in frozen tissues, eliminating the need to attempt expression studies in fixed tissues with their attendant biases. LCM of stromal tissue was completed for 6 normal prostates from men across the age range and of the two racial groups studied, and from prostates from men of similar ages with adenocarcinoma identified distant from the area of dissection. High Quality RNA was isolated, and duplicate Affymetrix Plus 2.0 chip analysis performed. We observe potentially significant expression differences in both normal epithelial and stromal cells from fully normal prostates as compared to prostates containing adenocarcinoma which are now subject to formal hypothesis testing.

DTIC

Cancer; Epithelium; Gene Expression; Genes; Human Beings; Males; Prostate Gland

20080006280 Johns Hopkins Univ., Baltimore, MD USA

Proof of Concept for Systematic Collection of Optimal Molecular Quality Anatomically Oriented Normal Prostate From Diverse Age and Race Transplant Donors

Bova, G S; Dec 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0084

Report No.(s): AD-A475128; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The lack of availability of high-quality whole normal human prostate tissue from subjects of various ages and races impedes prostate cancer research in several ways. It prevents examination of prostate molecular pathologic changes on a time continuum, thus preventing the establishment of a definition of what the range of normal cellular activity is in a human male prostate for any one age or race. Just as important, the lack of availability of well-curated whole normal prostate tissue across the age and race spectrum impedes the development of truly representative animal models of human disease. This project has completed or partially completed several key steps, each of which must be accomplished to a high degree of quality in order for this Resource Development prototype project to prove feasibility of a scaled-up version of this work, which will be necessary to provide sufficient sample numbers for many types of research. These steps are: IRB approval, Tissue Availability,

Tissue Collection, Tissue Archiving and Preparation, Tissue Sharing Protocol, and Database Integration. Progress in each aspect is discussed.

DTIC

Africa; Cancer; Males; Medical Science; Prostate Gland; Transplantation

20080006281 Beth Israel Deaconess Medical Center, Boston, MA USA

The Significance of Erythropoietin Receptor (EpoR) Acquisition by Breast Cancer Cells

Feldman, Laurie; Aug 2007; 21 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0522

Report No.(s): AD-A475130; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data from our lab and others indicate that normal breast cells do not express the erythropoietin receptor (EpoR); conversely breast cancer (Ca Br) cells express functional EpoR. Expression of EpoR appears greatest in poorly oxygenated tumor regions and in patients with negative estrogen receptor status a sign of more aggressive disease. Additionally one study demonstrated that the EpoR gene is overexpressed in patients with micrometastatic disease. The differential expression of EpoR between normal and cancerous breast cells has led us to hypothesize that acquisition of EpoR expression by mammary epithelial cells may be part of malignant transformation and may impact disease progression and metastasis. Our data demonstrating changes in mammary epithelial cell biology associated with acquisition of EpoR expression support this hypothesis and suggest that EpoR acquisition results in mammary epithelial cell with a premalignant phenotype. These data will help us better understand the oncogenic process in CaBr and may suggest the need for caution in administering Epo to (at least some) CaBr patients.

DTIC

Breast; Cancer; Erythrocytes; Hematopoiesis; Hormones; Mammary Glands

20080006282 Utah Univ., Salt Lake City, UT USA

Randomized Trial of Interleukin-2 (IL-2) as Early Consolidation Following Marrow Ablative Therapy with Stem Cell Rescue for Metastatic Breast Cancer

Samlowski, Wolfram E; Ward, John H; Buys, Sandra; Oct 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-99-1-9417

Report No.(s): AD-A475134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Interleukin-2 (IL-2) has the capacity to activate lymphocytes to kill multidrug resistant cancer cells. Our phase I data established the feasibility of administering a single course of low-dose IL-2 (1.6 million IU/m²/day as a continuous i.v. infusion for 18 days) as consolidation treatment to patients with metastatic breast cancer early after intensive chemotherapy. We are performing a phase II trial of AC+T chemotherapy followed by IL-2 consolidation (1 cycle as described above) in high-risk stage II and III breast cancer patients. Disease free survival and toxicity assessment represent major clinical aims (Specific aim 1). Immunologic effector mechanisms induced following MAT/SR by IL-2 infusion are being evaluated (Aim 2). This study opened 6/11/03. Fourteen patients have been accrued, all have completed planned treatment. Toxicity has been minimal. Laboratory correlation studies have been completed and the results of this trial will be submitted for publication in the next several months.

DTIC

Ablation; Bone Marrow; Breast; Cancer; Chemotherapy; Consolidation; Immune Systems; Interleukins; Mammary Glands; Rescue Operations; Stem Cells; Therapy

20080006287 Jackson (Henry M.) Foundation, Rockville, MD USA

Jet Fuel Exposure and Neurological Health in Military Personnel

Proctor, Susan P; Jul 2007; 13 pp.; In English

Report No.(s): AD-A475143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Jet propulsion fuel 8 (JP-8) has recently been recognized by the Department of Defense as the single largest chemical exposure for its personnel. The primary aim of the project is to conduct an epidemiological field study to examine the relationship between JP-8 fuel exposure and adverse neurological health in military personnel. The research objectives are as follows: (1) determination of the individual service member's level of exposure to JP-8 components while carrying his/her job tasks, as measured by specified biomarkers of exposure; and (2) examination of whether acute or cumulative exposure to JP-8 over a work week is significantly associated with hypothesized neurobehavioral and neurophysiologic performance outcomes. The project has two phases. During Tier I, the authors will conduct onsite exposure assessment techniques to fully characterize

JP-8 exposure parameters in the military occupational field setting required for the planned field study. During Tier II, they will conduct the full-scale neuroepidemiology field study to examine predicted dose-response relationships. The field study is being carried out with military (Air Force) personnel. The Tier I data collection phase has been completed; the Tier II phase is currently being planned.

DTIC

Armed Forces (United States); Exposure; Health; Jet Engine Fuels; JP-8 Jet Fuel; Military Personnel; Neurology; Neurophysiology

20080006288 General Accounting Office, Washington, DC USA

Military Health: DOD's Vaccine Healthcare Centers Network

Jun 29, 2007; 19 pp.; In English

Report No.(s): AD-A475145; GAO-07-787R; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Members of the military have long been required to receive immunizations.¹ The Department of Defense (DOD) estimates that over 2.2 million servicemembers² receive at least one mandatory immunization annually. Immunizations are provided through the administration of vaccines, which contain 'antigens' or parts of a specific virus or bacterium that are used to trigger an immune response to protect the body from disease. DOD's immunization requirements vary depending on several factors, such as a servicemember's branch of military service, location, age, and type of personnel, such as newly enlisted recruits, those conducting high-risk travel, and reserve forces.

DTIC

Medical Services; Telemedicine; Vaccines

20080006289 Wayne State Univ., Detroit, MI USA

Sam68 and Breast Cancer

Reddy, Thipparthi R; Aug 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0529

Report No.(s): AD-A475146; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Sam68 is a target for Src kinase. It is involved in HIV-1 RNA export. It has been well documented that patients have either lost or have mutations in BRCA1 or BRCA2 tumor suppressor genes are at high risk of developing breast cancers. Thus, the major goal of this application was to investigate whether Sam68 is involved in the export of BRCA1 mRNA. The other goal was to map the BRCA1 mRNA export pathway. To test this objective, we knocked down Sam68 in MCF7 cells. Sam68 knockdown cells expressed reduced levels of BRCA1 mRNA. However, it is not known whether the effect on BRCA1 is due to the transcriptional repression or RNA stability. More evidence came from the Sam68 dominant negative mutant approach, in which BRCA1 protein is repressed. This may account for the RNA instability. Using the Leptomycin B, we have shown that BRCA1 mRNA uses CRM1-dependent pathway. Taken together, our results suggest that Sam68 regulates BRCA1 RNA metabolism.

DTIC

Breast; Cancer; Mammary Glands; Ribonucleic Acids; Risk; Tumor Suppressor Genes; Viruses

20080006290 Texas Univ., Houston, TX USA

The Role of the Low Molecular Weight (LMW) Isoforms of Cyclin E in Breast Cancer Tumorigenesis

Wingate, Hannah; Jun 2007; 10 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-04-1-0414

Report No.(s): AD-A475147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Cyclin E is a positive regulator of the G1 to S phase transition of the cell cycle. In complex with CDK2 it is responsible for cells passing the restriction point, committing the cell to a round of DNA replication. Previously this laboratory found that cyclin E is overexpressed and present in lower molecular weight (LMW) isoforms in breast cancer cells and tumor tissues compared to normal cells and tissues. To investigate the role of the LMW forms of cyclin E in tumorigenesis we have developed a model system of non-tumorigenic breast cells overexpressing the individual isoforms of cyclin E. Using this model system we have determined that the LMW forms of cyclin E are associated with increased kinase activity that results in cell cycle deregulation, chromosomal instability and aneuploidy.

DTIC

Breast; Cancer; Deoxyribonucleic Acid; Enzymes; Low Molecular Weights; Mammary Glands; Molecular Weight; Phosphorus

20080006291 Mount Sinai School of Medicine, New York, NY USA

Diversity, Replication, Pathogenicity and Cell Biology of Crimean Congo Hemorrhagic Fever Virus

Garcia-Sastre, Adolfo; Oct 2007; 13 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0876

Report No.(s): AD-A475148; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research project is a result of a collaboration between three research groups aimed at elucidating basic replication processes of CCHFV with the expected outcome of providing basic research reagents and establishing the foundation of knowledge necessary for discovery of vaccines and antiviral therapeutics for Crimean Congo hemorrhagic fever. Our major findings during the third year of support are the following: We have demonstrated that the isopeptidase activity associated with the N-terminal of the L protein is responsible for overcoming innate immune responses mediated by ubiquitin and by the ubiquitin-like molecule ISG15, and that this activity is shared with the nsp2 of an unrelated virus family: the arteriviruses. This activity could be a target for antiviral development. We have characterized in more detail the Nsm protein of CCHFV and developed constructs with fusogenic activity based on expression of the G ORF. We have successfully passaged CCHFV 18 times in SCID mice and conducted preliminary studies in macaques. Our results provide novel insights on the molecular biology of this understudied highly pathogenic human virus.

DTIC

Africa; Cells (Biology); Drugs; Fever; Hemorrhages; Microorganisms; Monkeys; Pathogens; Viral Diseases; Viruses

20080006292 General Accounting Office, Washington, DC USA

DEFENSE HEALTH CARE: Access to Care for Beneficiaries Who Have Not Enrolled in TRICARE's Managed Care Option

Crosse, Marcia; Dec 2006; 72 pp.; In English

Report No.(s): AD-A475151; GAO-07-48; No Copyright; Avail.: Defense Technical Information Center (DTIC)

TMA and its MCSCs use various methods to evaluate access to care, and according to TMA and MCSC officials, the resulting measures indicate that nonenrolled TRICARE beneficiaries access to care is generally sufficient and that access problems appear to be minimal. Among methods used by TMA to evaluate access to care are its recently implemented civilian provider survey and an annual beneficiary health care survey. The survey of civilian providers, which includes network and nonnetwork providers, is designed to measure access to care by identifying how many civilian providers are willing to accept nonenrolled TRICARE beneficiaries as new patients. The first round of this survey, implemented in 2005, focused on 20 states and found that 14 percent of civilian providers were not accepting new patients from any government or commercial health plan. Of those accepting new patients, about 80 percent would accept nonenrolled TRICARE beneficiaries as new patients. In addition, the results of each of TMA's annual beneficiary health care surveys for 2003 through 2005 show that nonenrolled TRICARE beneficiaries satisfaction with access to care was similar to satisfaction reported by participants in commercial health plans. TMA and the TROs also receive anecdotal information through beneficiary feedback, and, according to these officials, complaints about access to care are infrequent. Each of the MCSCs also has its own methods of monitoring access to care, including analyzing provider and beneficiary locations as part of their responsibility for ensuring sufficient network capacity for all TRICARE beneficiaries residing in locations with civilian provider networks. While the MCSCs methods were not designed specifically to evaluate access for nonenrolled TRICARE beneficiaries, they do provide helpful information that allows the MCSCs to monitor the availability of both network and nonnetwork civilian providers for this population. According to MCSC officials, their measures indic

DTIC

Health; Surveys

20080006293 General Accounting Office, Washington, DC USA

MILITARY HEALTH: Increased TRICARE Eligibility for Reservists Presents Educational Challenges

Feb 2007; 39 pp.; In English

Report No.(s): AD-A475153; GAO-07-195; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since 2001, the number of reservists mobilized for active duty has increased dramatically. Congress has expanded reservists' and their dependents' eligibility for TRICARE, the Department of Defense's (DOD) health insurance program. The National Defense Authorization Act (NDAA) for Fiscal Year 2004 directed GAO to examine the health insurance coverage of reservists and their dependents. This report (1) identifies the extent to which reservists have civilian health insurance, (2) examines DOD's efforts to educate reservists and their dependents about TRICARE, and (3) describes reservists level of satisfaction with TRICARE and the types of problems reservists and their dependents experienced when using it. To do this,

GAO relied on interviews with DOD and DOD's survey data. GAO also administered a survey of TRICARE benefit assistance coordinators.

DTIC

Education; Reserves

20080006294 General Accounting Office, Washington, DC USA

MILITARY HEALTH CARE: TRICARE Cost-Sharing Proposals Would Help Offset Increasing Health Care Spending, but Projected Savings Are Likely Overestimated

May 2007; 53 pp.; In English

Report No.(s): AD-A475154; GAO-07-647; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In light of the fact that Department of Defense (DOD) health care spending more than doubled from 2000 to 2005 and continues to escalate, DOD proposed increasing the share of health care costs paid by TRICARE beneficiaries, under a proposal known as Sustain the Benefit. DOD estimated that if the proposal had been implemented in fiscal year 2007, savings would amount to over \$11 billion through fiscal year 2011. As required by the National Defense Authorization Act for 2007, GAO evaluated (1) the likelihood that DOD would achieve its estimated savings from the proposed enrollment fee and deductible increases for retirees and dependents under age 65, (2) the likelihood that DOD would achieve its estimated savings from the proposed pharmacy co-payment increases for all beneficiaries except active duty personnel, and (3) the factors identified by DOD as contributing to increased TRICARE spending from 2000 to 2005. To conduct its work, GAO examined DOD analyses and interviewed DOD officials. GAO also analyzed data on many aspects of health care costs in general and interviewed health economists.

DTIC

Cost Estimates; Cost Reduction; Health

20080006295 Chicago Univ., Chicago, IL USA

Correlative Feature Analysis for Multimodality Breast CAD

Yuan, Yading; Sep 2007; 60 pp.; In English

Contract(s)/Grant(s): W81XWH-06-1-0726

Report No.(s): AD-A475156; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to develop correlative feature analysis methods for integrating image information from multi-modality breast images taking advantage of the information from different views and/or different modalities and thus improving the sensitivity and specificity of breast cancer diagnosis. Identifying the corresponding image pair of a lesion is an essential step for this purpose. During the first year we have collected and maintained a multi-modality breast image database which includes full field digital mammography (FFDM) sonography and MRI images. To differentiate corresponding FFDM image pairs from non-corresponding ones in which images were obtained from CC and ML view respectively we have developed computerized methods for lesion segmentation feature extraction and selection feature correlation analysis and image pair classification. The results have shown that our computerized feature correlative analysis has great potential in identifying the corresponding image pair of a lesion obtained from different views of the same modality.

DTIC

Breast; Cancer; Computer Aided Design; Mammary Glands

20080006297 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Profiling Jet Fuel on Neurotoxic Components With Comprehensive Two-Dimensional GC

Trap, Henk C; Nov 2007; 85 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-07-1-0002

Report No.(s): AD-A475160; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Exposure to jet-propulsion fuel 8 (JP-8) is probably the most occurring chemical exposure within the military. The discussion on the possible adverse health effects of such an exposure is ongoing. Methodology is needed to identify and quantify low concentrations of potentially toxic components in the complex JP-8 matrix. Comprehensive GC (GCxGC), in which continuous two-dimensional separation occurs, was shown to be highly suitable for this purpose. In combination with time-of-flight mass-spectrometry up to 3,500 components in JP-8 could be chromatographically resolved, in most cases identified and (semi-)quantified. Differences in composition between JP-8 from various sources and with various ages were demonstrated. This technology was used to establish the evaporation profiles at -10 and 20 C of 20 components that are

considered to be potentially neurotoxic. Rough estimates of the external exposures of personnel were made from these evaporation profiles as well as preliminary toxicological evaluations.

DTIC

Jet Engine Fuels; Physical Examinations; Toxicology

20080006298 Albert Einstein Coll. of Medicine, Bronx, NY USA

Targeting Radiation Therapy for Developing Dendritic Cell Based Immunotherapy of Metastatic Prostate Cancer

Chakravarty, Prabir K; Jan 2006; 72 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0006

Report No.(s): AD-A475161; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this proposal the effectiveness of developing a novel immunotherapeutic strategy following Radiotherapy for prostate cancer has been explored. The hypothesis was tested using a murine prostate cancer model, RM-1. The study showed that irradiation induces apoptosis and the irradiated tumor cells were able to activate dendritic cells and stimulate tumor specific immune response in vitro. In vivo immunization of animals with activated DCs was able to increase their survival against subsequent challenge with tumor cells. Treatment with CCL-21 following DC expansion by FL+IL-12 in animals bearing irradiated tumor, significantly increased their survival time when they were challenged with tumor cells. This regimen also generated a tumor specific immune response as evidenced by in vitro studies. Similar protection was observed when CD40L was used instead of CCL-21 following treatment with FL+IL-12. The study further showed that the administration of adenovirus (Ad-CCL-21) to prostate tumor bearing animals significantly increased their survival time. Collectively, our study provides a novel approach to treat advanced prostate cancer patients following radiotherapy. A protocol for treating prostate cancer patients undergoing radiotherapy could be developed immediately based on these findings.

DTIC

Adenoviruses; Cancer; In Vivo Methods and Tests; Metastasis; Prostate Gland; Radiation Therapy

20080006304 General Accounting Office, Washington, DC USA

MILITARY PAY: Processes for Retaining Injured Army National Guard and Reserve Soldiers on Active Duty Have Been Improved, but Some Challenges Remain

May 2007; 43 pp.; In English

Report No.(s): AD-A475173; GAO-07-608; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In February 2005, GAO reported that weaknesses in the Army's Active Duty Medical Extension (ADME) process caused injured and ill Army National Guard and Reserve (reserve component) soldiers to experience gaps in pay and benefits. During the course of GAO's previous work, the Army implemented the Medical Retention Processing (MRP) program in May 2004 and Community-Based Health Care Initiative (CBHCI) in March 2004. CBHCI allows reserve component soldiers on MRP orders to return home and receive medical care through a civilian health care provider. As directed by congressional mandate, GAO determined whether (1) MRP has resolved the pay issues previously identified with ADME and (2) the Army has the metrics it needs to determine whether it is effectively managing CBHCI program risks. GAO's scope did not include the medical, facilities, or disability ratings issues recently reported by the media at Walter Reed Army Medical Center.

DTIC

Armed Forces (United States); Medical Services; Military Personnel

20080006305 General Accounting Office, Washington, DC USA

Military Personnel: Medical, Family Support, and Educational Services Are Available for Exceptional Family Members

Crosse, Marcia; Mar 16, 2007; 19 pp.; In English

Report No.(s): AD-A475175; GAO-07-317R; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Department of Defense's (DOD) Exceptional Family Member Program (EFMP) is a mandatory enrollment program for active duty servicemembers who have family members with special medical needs. The Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005 directed us to evaluate the effect of EFMP on health, support, and education services in selected civilian communities with a high concentration of EFMP enrollees. As discussed with the committees of jurisdiction, this report describes (1) the services provided by the military health and family support systems that are available to meet the needs of exceptional family members within the USA, and (2) state and local services including medical, family support, and educational services available for the exceptional family members in select communities. To describe the services provided by the military health and family support systems that are available to meet the needs of exceptional family members

within the USA, we reviewed federal law and regulations, TRICARE policies, agency documentation, and other sources related to EFMP. In addition, we interviewed TRICARE Management Activity (TMA) officials and EFMP officials for each military service Army, Navy, Air Force and the Marine Corps. We interviewed local military officials in the following four selected communities: San Diego, California (Navy and Marine Corps); Fayetteville, North Carolina (Army and Air Force); San Antonio, Texas (Army and Air Force); and the Hampton Roads area, Virginia (Army, Navy, and Air Force). To describe state and local services including medical, family support, and educational available to exceptional family members in these four communities, we interviewed officials from state and local agencies that provide these services within the four communities we selected.

DTIC

Education; Medical Services; Military Personnel; Support Systems

20080006308 Medical Univ. of South Carolina, Charleston, SC USA

Measles Virus Nucleocapsid (MVNP) Gene Expression and RANK Receptor Signaling in Osteoclast Precursors, Osteoclast Inhibitors Peptide Therapy for Pagets Disease

Reddy, Sakamuri V; Oct 2007; 27 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0763

Report No.(s): AD-A475186; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Pagers disease (PD) of bone occurs in 3-4% of population over the age of 50. We have identified expression of measles virus nucleocapsid transcripts in osteoclast (OCL) precursors and that MVNP expression induces pagetic phenotype in osteoclasts with increased bone resorption activity as seen in patients with Pagets disease. We previously cloned and identified osteoclast inhibitory peptide-I (OIP-I) which inhibits osteoclast formation and bone resorption. We hypothesize that MVNP expression in osteoclast precursors modulates RANK receptor signaling leading to Pagetic OCL development. OIP-I blocks these signaling events and inhibits MVNP induced osteoclastogenesis and elevated bone resorption activity. We demonstrated that MVNP increases TN F-alpha induced OCL differentiation and activation by increasing NF-kB signaling through increased expression of p62 and IKK-gamma and increased MAPK signaling. Our results also suggest that MVNP's effects on TN F-alpha signaling contribute to the increased OCL formation in PD. Furthermore expression of MVNP gene in OCL in vivo induces a pagetic-like phenotype. RANKL stimulation of OIP-I mice derived bone marrow cells resulted in significantly decreased osteoclast formation. Furthermore OIP-I transgenic mouse bones demonstrated an osteopetrotic phenotype. These data suggest that OIP-I is an important physiologic regulator of osteoclast development and bone resorption in vivo and may have therapeutic utility to control excess bone turnover in patients with Pagets disease.

DTIC

Bone Demineralization; Diseases; Gene Expression; Inhibitors; Peptides; Therapy; Viruses

20080006320 Science Applications International Corp., Abingdon, MD USA

Evaluation, Validation, and Demonstration of a Total Protein Assay for Application to Biotoxin Fate Studies

Morrissey, Kevin M; Schenning, Amanda M; Bevilacqua, Vicky L; Rice, Jeffrey S; Oct 2007; 46 pp.; In English

Contract(s)/Grant(s): DAAD13-03-D-0017

Report No.(s): AD-A475212; ECBC-TR-576; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes efforts to evaluate, optimize, and validate a commercially available analytical assay for the quantitative determination of total protein in aqueous sample matrices. The data generated during this study will be used to support on-going investigations into the fate of biotoxins in aqueous environments. The optimized assay was found to be repeatable, reproducible, and not subject to interference by several different water matrices. The method limit of detection was determined to be 0.350 mg/L, and the method limit of quantization was determined to be 1.17 mg/L. The linear range was determined to be 1.00 to 25.0 mg/L of total protein.

DTIC

Assaying; Decontamination; Measurement; Proteins

20080006321 Alabama Univ., Birmingham, AL USA

Natural History of Plexiform Neurofibromas in NF1

Korf, Bruce R; Oct 2007; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-98-1-8611

Report No.(s): AD-A475213; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of this study is to use volumetric MRI to define the natural history of untreated plexiform neurofibromas

in patients with NF1. Recruitment has been completed including patients with head and neck or trunk and extremity plexiform neurofibromas with serial MRI studies done over a three year period. Volumetric analysis is nearly completed delayed by a two year hiatus in the study when the PI moved from Boston to Birmingham. In addition to completing the volumetric analysis we plan to validate the volumetric data by complete review of all MRIs done on all patients and use of two independent approaches to volumetric analysis. This will insure that data on tumor volumes is reliable given that several years have elapsed between initial and final studies. It will also link the data in the present study to two ongoing initiatives: the NF Consortium which is conducting clinical trials and the Children's Tumor Foundation funded plexiform neurofibroma imaging repository.

DTIC

Imaging Techniques; Magnetic Resonance; Volumetric Analysis

20080006322 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands

Monitoring and Counteracting Functional Deterioration in Parkinson's Disease: A Multilevel Integrative Approach in a Primate Model System

Philippens, Ingrid H; Verhave, Peternella S; Jongsma, Marjan J; Blezer, Erwin; Mol, Marijke A; Sep 2007; 23 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0517

Report No.(s): AD-A475214; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is still largely unknown what the general course is in the progression of Parkinson's disease (PD). Presumably more than one factor is responsible. There is evidence suggesting that metabolic compromise excitotoxicity and oxidative stress are involved in the neurodegenerative process causing PD. To investigate the connection of excitotoxicity and oxidative stress with metabolic compromise in the development of the disease anti-excitotoxic treatment with riluzole and anti-oxidant treatment with EGCG will be compared to untreated controls and to a standard treatment with L-DOPA in a MPTP induced Parkinson model. We hypothesize that critical changes indicating the nature of the gradual patho-physiological changes leading to PD will be revealed if anti-oxidants or anti-excitatory treatments are given in a situation where the brain is susceptible to develop PD. The comparison of the results on the different levels of research between the neuroprotective regimes and the symptom control drug L-DOPA will give insight in the relative role of the different markers for neuroprotection and behavioral output. In particular relatively new technologies such as differential proteomics and sleep research will yield novel insights. In this report period new test methods were developed the use of brain imaging or neurophysiology was validated and the dose range finding of the test compounds was performed. The highest sign-free dose will be used in the neuroprotective experiments.

DTIC

Cells (Biology); Deterioration; Diseases; Nervous System; Primates

20080006324 National Inst. of Health, Hamilton, MT USA

High-Throughput Screening of Compounds for Anti-Transmissible Spongiform Encephalopathy Activity Using Cell-Culture and Cell-Free Models and Infected Animals

Caughey, Byron; Kocisko, David; Jul 2007; 33 pp.; In English

Contract(s)/Grant(s): MIPR-3JD3G53125

Report No.(s): AD-A475225; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No effective treatments have been validated for the transmissible spongiform encephalopathies (TSEs) or prion diseases. To advance the rational basis for the search for anti-TSE therapeutics, we have developed a new unified mechanistic model for the activity of various classes of PrPSc inhibitors which is consistent with a considerable body of evidence from our laboratory and others. Based on this model, we have successfully developed a new potentially high-throughput screen for new anti-TSE compounds which is based on monitoring the ability of compounds to compete with the binding of a well-characterized anti-TSE compound (a PS-ON) to PrP-sen. Finally, we have discovered that combination drug treatments can substantially improve survival times of animals with established TSE infections of the central nervous system.

DTIC

Animals; Cells (Biology); Culture Techniques; Encephalitis; Infectious Diseases

20080006327 College of William and Mary, Williamsburg, VA USA

In Vivo Molecular Imaging of Mammary Tumorigenesis in Murine Model Systems

Saha, Margaret S; Aug 2007; 35 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0480

Report No.(s): AD-A475236; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The development of accurate diagnostic tools and effective breast cancer treatments requires the ability to detect the

presence of pre-cancerous, cancerous, and metastatic tissue and to identify the particular subtype or class of tumor. It is equally imperative to develop the capability of performing a 'molecular diagnosis' non-invasively, employing in vivo imaging technologies in order to follow the tumor progression over time. This project entails an interdisciplinary approach which employs a gamma-ray-camera detector system to follow, during tumorigenesis, the uptake of NaI through the Na⁺/I⁻ symporter, and the binding characteristics and localization of vascular endothelial growth factor, epidermal growth factor, and estradiol in mouse models of breast cancer. Using the MMTV model for mammary tumor development, we have found that I-125 labeled sodium iodide provides a valuable tag for imaging mammary tumors at several different stages of their development. Moreover, it is also able to provide an image of the heterogeneity among tumors and within a given tumor, making it potentially useful as a strategy for non-invasively imaging and classifying mammary tumors for purposes of prognosis.

DTIC

Imaging Techniques; In Vivo Methods and Tests; Mammary Glands; Neoplasms; Rodents

20080006330 Stanford Univ., Stanford, CA USA

Selective Androgen Receptor Down-Regulators (SARDs): A New Prostate Cancer Therapy

Bhattacharyya, Rumi S; Oct 2007; 29 pp.; In English

Contract(s)/Grant(s): W81XWH-05-1-0582

Report No.(s): AD-A475249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The androgen receptor (AR) plays a key role in the development and progression of prostate cancer. Targeting the AR for down-regulation would be a useful strategy for treating prostate cancer, especially hormone-refractory or androgen independent prostate cancer (AIPC). In the present study we showed that the antiestrogen Fulvestrant (ICI 182,780, ICI) effectively suppressed AR expression in several human prostate cancer cells including androgen-independent cells. In LNCaP cells, ICI (10 microM) treatment decreased AR mRNA expression by 43% after 24 hours and AR protein expression by approximately 50% after 48 hours. We further examined the mechanism of AR down-regulation by ICI in LNCaP cells. ICI did not bind to the T877A mutant AR present in the LNCaP cells nor did it promote proteasomal degradation of the AR. ICI did not affect AR mRNA or protein half-life. However, ICI decreased the activity of an AR promoter-luciferase reporter plasmid transfected into LNCaP cells, suggesting a direct repression of AR gene transcription. As a result of AR down-regulation by ICI, androgen induction of PSA mRNA and protein expression were substantially attenuated. Importantly, LNCaP cell proliferation was significantly inhibited by ICI treatment. Following 6 days of ICI treatment a 70% growth inhibition was seen in androgen stimulated LNCaP cells. These data demonstrate that the antiestrogen ICI is a potent AR down-regulator that causes significant inhibition of prostate cancer cell growth. Our study suggests that AR down-regulation by ICI would be an effective strategy for the treatment of all prostate cancer, especially AR-dependent AI PC.

DTIC

Cancer; Estrogens; Hormones; Males; Modulators; Prostate Gland; Regulators; Therapy

20080006331 Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

Center for the Evaluation of Biomarkers for Early Detection of Breast Cancer

Urban, Nicole; Oct 2007; 29 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0691

Report No.(s): AD-A475250; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Breast Cancer remains a leading cause of death for women in the US despite the popularity of mammography as a preventive tool. At diagnosis many breast cancers are at an advanced stage of disease even for women undergoing annual screening resulting in costly and painful follow-up procedures. It has been shown that molecular markers can increase our ability to diagnose early stage tumors. This has been demonstrated by current clinical practices using the CA-125 marker and PSA for the detection of ovarian and prostate cancer respectively. The purpose of this study is to search for breast cancer biomarkers and evaluate their effectiveness in detecting early stage carcinoma. By combining molecular diagnosis with current imaging analysis of breast tissue we may further reduce the number of deaths as well as the number of women undergoing surgery due to breast cancer. To date we have created the infrastructure necessary for our interdisciplinary team of investigators to obtain study samples from a well-characterized population, analyze candidate biomarkers and efficiently communicate research findings. We are also exploring more efficient and sensitive biotechnology that may better assist our study investigators.

DTIC

Biomarkers; Breast; Cancer; Detection; Mammary Glands

20080006333 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands
Feasibility of Biomonitoring of Exposure to Permethrin Through Analysis of Long-Lived (Metabolite) Adducts to Proteins

Noort, Daan; Sep 2007; 42 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0516

Report No.(s): AD-A475256; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Biomonitoring of exposure to the insecticide permethrin is usually performed by analysis of its urinary metabolite 3-phenoxybenzoic acid (3- PBA). However, chronic low-level exposures and cumulative exposures cannot be assessed by analyzing urinary biomarkers. We are engaged in the development of a methodology to assess the cumulative internal dose of exposure to permethrin, which is based on the assumption that (reactive) glucuronide conjugates of the major permethrin metabolites 3-PBA and cis/trans-3-(2,2-dichlorovinyl)-2,2- dimethylcyclopropane-1-carboxylic acid (cis/trans-Cl2CA) will form persistent adducts to proteins, in analogy with the glucuronide conjugates of structurally related drugs. In the second year of the project the adduct formation of the glucuronides of 3-PBA and Cl2CA was studied in plasma. A method was developed for analysis of albumin adducts of the glucuronides, which is based on pronase digestion of albumin followed by LC-tandem MS analysis of the lysine adducts. For 3-PBA glucuronide, it was attempted to quantify adduct formation by using [14C] labelled 3-PBA glucuronides, obtained by combined chemical and enzymatic synthesis. Quantitation was thwarted due to non-covalent association of the glucuronides to the proteins. It is envisaged that the obtained results will form a firm basis for development of an adductbased methodology for biomonitoring exposure to permethrin, and that the results will give valuable toxicological information that can be used for risk assessment for the current large-scale use of permethrin.

DTIC

Adducts; Albumins; Exposure; Metabolites; Proteins

20080006334 Duke Univ., Durham, NC USA
Miniature and Molecularly Specific Optical Screening Technologies for Breast Cancer

Ramanujam, Nirmala; Oct 2007; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0363

Report No.(s): AD-A475257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The goal of this proposal is to harness the power of light to create miniature and molecularly specific optical technologies for breast cancer diagnosis and detection. The miniature technologies will leverage on millimeter scale silicon detectors and LEDs to make compact devices that can be used in a practical clinical setting for breast cancer detection. The features that will be exploited for optical detection/diagnosis of breast cancer will include the physiological, structural and molecular alterations that accompany the transformation of a cell from a normal to malignant state. This proposal also focuses on using contrast agents, specifically aminolevulinic acid (ALA) induced protoporphyrin IX (PpIX), for the molecular detection of breast cancer.

DTIC

Breast; Cancer; Clinical Medicine; Detection; Fiber Optics; Mammary Glands; Miniaturization; Optical Measurement

20080006335 West Virginia Univ., Morgantown, WV USA
Randomized Trial of Neuroprotective Effects of Erythropoietin in Patients Receiving Adjuvant Chemotherapy for Breast Cancer: Positron Emission Tomography and Neuropsychological Study. Addendum

Abraham, James; Konat, Gregory; Krasowska, Alicia; Sep 2007; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0621

Report No.(s): AD-A475259; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Animal Research Study Amendment An amendment to the study was initiated in April 2005 to include animal experiments. As per published literature, proinflammatory cytokines play a role in the pathogenesis of cognitive dysfunction. The experiments were designed to assess the cytokines before and after chemotherapy in a rat model. We have established an experimental animal model to study chemotherapy-induced cognitive dysfunction observed in the clinical setting. In this model administration of four weekly doses of clinical chemotherapeutics, i.e., the combination of adriamycin and cytoxan, results in impaired memory function in rats. We propose to further characterize the mechanisms of this cognitive dysfunction by molecular genomics approach. We will analyze global gene expression in the hippocampi from treated vs. control rats using the microarray methodology. This analysis will allow us to identify genes whose expression is altered by the chemotherapeutic treatment. Subsequently, expression of these genes will be analyzed by real time RT-PCR to confirm the microarray results, to precisely quantify the differential expression of these genes, and to further streamline the selection of putative genes that underscore the memory impairment. This study will provide important information for future, more clinically oriented

endeavors to determine the correlation between the polymorphism of these genes and the susceptibility of patients to chemotherapy-induced cognitive dysfunction.

DTIC

Breast; Cancer; Chemotherapy; Drugs; Erythrocytes; Hematopoiesis; Hormones; Mammary Glands; Neurology; Patients; Positrons; Psychology; Tomography

20080006337 Hutchinson (Fred) Cancer Research Center, Seattle, WA USA

Modifiable Risk Factors for Lymphedema in Breast Cancer Survivors

Rossing, Mary A; Malone, Kathleen E; Oct 2007; 26 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0387

Report No.(s): AD-A475261; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this study, 433 women with invasive breast cancer who had >5 axillary lymph nodes removed were followed for the development of arm lymphedema. Participants completed a baseline interview and subsequent interviews at 6-9 month intervals. Lymphedema was identified through self-report and through measurement of arm volume. Slightly more than half of participants reported arm swelling (n=228; 52.7%). Measured arm volume excess of >10% comparing the surgery-side to the opposite arm was identified in 73 women (16.9%). For both self-reported and measured lymphedema, risk was increased among women with greater body mass. For measured lymphedema only, risk was increased among current smokers and reduced among women in the highest category of recreational physical activity. Our results suggest that maintaining normal body mass, abstaining from smoking, and regular recreational physical activity should be investigated further as prevention strategies for lymphedema, particularly for lymphedema that progresses to more severe disease.

DTIC

Breast; Cancer; Females; Health; Lymph; Mammary Glands; Risk

20080006339 Boston Univ., Boston, MA USA

Barriers to Therapy: A Novel 3-D Model to Study the Effect of Tumor Interstitial Pressure on Endocrine-Resistant Breast Cancer

Klapperich, Catherine; Rosen, Jennifer; Jul 2007; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-06-1-0602

Report No.(s): AD-A475265; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The breast cancer microenvironment poses a formidable barrier to effective therapy. The pathophysiologic mechanisms underlying treatment resistance in breast cancer are not known; in part this is due to the lack of a suitable, well-characterized model. Our purpose was to develop a 3D breast cancer culture system capable of reproducing the tumor microenvironment. We cultured MCF-7, a human breast cancer cell line, under three conditions: on polystyrene, on a two-dimensional collagen gel, and on a 3-dimensional collagen gel. The extent of phenotypic abnormality was assessed by changes in morphology on phase-contrast images and alterations in gene expression by qRT-PCR. Expression of E-cadherin, c-kit, MMP-2, MMP-12 and MMP-19 in MCF-7 grown on polystyrene was significantly higher than in MCF-7 grown in the three-dimensional collagen gel. TGF-beta expression was significantly higher in MCF-7 cells grown in the three-dimensional collagen gel compared to polystyrene. Gene expression in the two-dimensional gels trended towards that seen in the 3D gels but was not statistically significant. MCF-7 cells grown in 3D formed small, loose aggregates in comparison to the stellate appearance of cells grown on polystyrene. We can non-destructively grow and image live breast cancer cells. We were able to build an improved, precisely defined synthetic scaffold that better replicates the gene expression changes seen in human breast cancer, demonstrate that three-dimensional growth affects the expression of genes important in cell-cell adhesion and cell invasion, and non-destructively image these cells.

DTIC

Breast; Cancer; Endocrinology; Interstitials; Mammary Glands; Pressure Effects; Therapy; Three Dimensional Models; Tumors

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*.

20080003131 Army Research Inst. for the Behavioral and Social Sciences, Fort Rucker, AL USA

Simulator Sickness Research Summary

Johnson, David M; Jul 2007; 29 pp.; In English

Report No.(s): AD-A474304; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Flight Simulators; Motion Sickness; Simulators

20080003191 Ineris Verneuil, Halatte, France

Report of the IEEE ICES/COST 281 Thermal Physiology Workshop Held in Paris, France on September 22-24, 2004

Adair, Eleanor R; Feb 27, 2006; 40 pp.; In English

Contract(s)/Grant(s): FA8655-04-1-5064

Report No.(s): AD-A474422; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Final Proceedings for ICES/COST 281 Thermal Physiology Workshop, 22 September 2004 - 25 September 2004. The goal of the workshop is to develop appropriate techniques for predicting the thermophysiological responses of humans who are exposed to RF/MW fields at specific frequencies, field strengths, and dosimetry, both experimental and theoretical. We will validate modeling predictions with existing human exposure data. Topics include: Environmental physiology under heat stress (whole body and selected tissues); Descriptions of available models (physiological, dosimetric, and FD-TD); Techniques for combining models with classical physiological data and theoretical and experimental RF dosimetry.

DTIC

Costs; France; Human Body; Ice; Microwaves; Radio Waves

20080003206 Army Research Inst. of Environmental Medicine, Natick, MA USA

Use of Humidex to Set Thermal Work Limits for Emergency Workers in Protective Clothing

Santee, W R; Wallace, R F; May 2005; 4 pp.; In English

Report No.(s): AD-A474458; M05-21; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Humidex (HD) is a temperature-humidity index used to provide guidance concerning heat hazards based on normal activities and clothing. Personnel responding to security or NBC threats often wear body armor or protective clothing which can impose a greater heat burden. Our proposal was to use HD to provide short-term guidance for specialized clothing. Our Heat Strain Decision Aid model was used to calculate rectal temperature (T_{re}) values for combinations of temperature and humidity. Corresponding HD values were calculated using T_a , T_{dp} , and constants for other inputs. Activity levels were light (139 W m^{-2}), medium (236 W m^{-2}) and heavy (333 W m^{-2}). Equations were calculated for the relationship between T_{re} and HD. The mean R^2 value for 24 polynomial equations was 0.97. To evaluate the utility of the prediction, the difference between T_{re} predicted by the equation and the model was calculated. The average maximum difference was 0.71 C. There was a clear relationship between HD and predicted thermal strain, but differences increase as T_{re} increases, until some differences fall outside of acceptable levels. For general use, the upper limit of the relationship between HD and T_{re} could be used to set conservative guidelines for a given level of thermal strain (T_{re}) and activity, but for true emergencies, better guidance is necessary.

DTIC

Emergencies; Heat; Personnel; Protective Clothing; Thermal Stresses

20080003861 NASA Johnson Space Center, Houston, TX, USA

Comparison of Bystander Cardiopulmonary Resuscitation (BCPR) Performance in the Absence and Presence of Timing Devices for Coordinating Delivery of Ventilatory Breaths and Cardiac Compressions in a Model of Adult Cardiopulmonary Arrest

Hurst, Victor, IV; West, Sarah; Austin, Paul; Branson, Richard; Beck, George; [2006]; 17 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS9-02078; Copyright; Avail.: CASI: A03, Hardcopy

Astronaut crew medical officers (CMO) aboard the International Space Station (ISS) receive 40 hours of medical training

during the 18 months preceding each mission. Part of this training includes two-person cardiopulmonary resuscitation (CPR) per training guidelines from the American Heart Association (AHA). Recent studies concluded that the use of metronomic tones improves the coordination of CPR by trained clinicians. Similar data for bystander or 'trained lay people' (e.g. CMO) performance of CPR (BCPR) have been limited. The purpose of this study was to evaluate whether use of timing devices, such as audible metronomic tones, would improve BCPR performance by trained bystanders. Twenty pairs of bystanders trained in two-person BCPR performed BCPR for 4 minutes on a simulated cardiopulmonary arrest patient using three interventions: 1) BCPR with no timing devices, 2) BCPR plus metronomic tones for coordinating compression rate only, 3) BCPR with a timing device and metronome for coordinating ventilation and compression rates, respectively. Bystanders were evaluated on their ability to meet international and AHA CPR guidelines. Bystanders failed to provide the recommended number of breaths and number of compressions in the absence of a timing device and in the presence of audible metronomic tones for only coordinating compression rate. Bystanders using timing devices to coordinate both components of BCPR provided the recommended number of breaths and were closer to providing the recommended number of compressions compared with the other interventions. Survey results indicated that bystanders preferred to use a metronome for delivery of compressions during BCPR. BCPR performance is improved by timing devices that coordinate both compressions and breaths.

Author

Adults; Heart Function; Timing Devices; Cardiology; Aerospace Medicine; Resuscitation; Respiration

20080005239 Army Research Inst. of Environmental Medicine, Natick, MA USA

Assessment of Male Anthropometric Trends and the Effects on Thermal Regulatory Models

Yokota, Miyo; Bathalon, Gaston P; Berglund, Larry G; Aug 2007; 5 pp.; In English

Report No.(s): AD-A474523; P07-77; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study investigated temporal differences in body dimensions (height, weight, percent body fat (%BF)) of U.S. Army male soldiers by comparing 2004 and 1988 databases. Identified anthropometric somatotypes were subsequently incorporated in a thermal regulatory model to examine simulated individual differences in core temperature (T_{cr}) to heat stress (35 C/50%rh, ~550W work rate, rest for 30min and walk for 70 min). A significant increase in body weight (2.4kg) was observed between the 2004 and 1988 data ($p < 0.05$, after Bonferroni correction). However, changes in height and circumference measurements for %BF were insignificant, with the magnitude of the changes not exceeding inter-observer errors. Multivariate analyses demonstrated that anthropometric distributions did not differ between the two databases and identified five primary somatotypes: 'tall-fat,' 'tall-lean,' 'average,' 'short-lean,' and 'short-fat.' Within each database, anthropometric values differed among the somatotypes. However, simulated T_{cr} responses to heat stress in each somatotype were similar in the 2004 and 1988 populations. In conclusion, an increase in body weight was the primary change observed in the U.S. Army male soldiers. Temporal changes in somatotypes of soldiers over a 16 year period had minimal impact on simulated physiological response to heat stress using a thermal regulatory model.

DTIC

Anthropometry; Males; Models; Temperature Control; Temperature Distribution; Trends

20080005241 Army Research Inst. of Environmental Medicine, Natick, MA USA

Assessment of Anthropometric Trends and the Effects on Thermal Regulatory Models: Females Versus Males

Yokota, Miyo; Bathalon, Gaston P; Berglund, Larry G; Aug 2007; 5 pp.; In English

Report No.(s): AD-A474531; P07-78; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to investigate secular change in body dimensions (height, weight, %body fat (%BF)) in U.S. Army female soldiers, by comparing the 2004 and 1988 databases. Identified anthropometric somatotypes were subsequently incorporated in a thermal regulatory model to examine simulated individual differences in core temperature (T_{cr}) to heat stress (rest for 30 min and walk @ 3mph with 12 kg load in 35 C/50%rh environment for 70 min). The results were also compared to those from the male study. The univariate results indicated that the secular trend, greater increases in weight (3.1kg) and %BF (1.8%) ($p < 0.05$, after Bonferroni correction) than men were observed in the 2004 database. Multivariate results demonstrated that five primary somatotypes ('tall-fat,' 'tall-thin,' 'average,' 'short-thin,' 'short-fat') were identified. Despite the increase in 'fatness,' the secular trend of female body composition in multivariate dimensions and its effects on T_{cr} were not significantly different between the 1988 and 2004 databases. Anthropometric values in each somatotype differed by gender but surprisingly affected minimal gender differences in predicted T_{cr} to heat stress simulations..

DTIC

Anthropometry; Females; Males; Multivariate Statistical Analysis; Thermodynamic Properties; Trends

20080006437 NASA Johnson Space Center, Houston, TX, USA

WISE-2005: LBNP/Treadmill and Resistive Exercise Countermeasures Maintain Aerobic Capacity during a 60-d Bed Rest

Schneider, Suzanne M.; Lee, Stuart M. C.; Watenpaugh, Donald E.; Macias, Brandon R.; Hargens, Alan R.; May 31, 2006; 1 pp.; In English; American College of Sports and Medicine Annual Meeting, 31 May - 3 Jun. 2006, Denver, CO, USA
Contract(s)/Grant(s): NAS9-02078; NNJ04HF71 G; Copyright; Avail.: Other Sources; Abstract Only

We have previously documented that supine treadmill exercise within lower body negative pressure (LBNPex) performed 6 sessions (raised dot) wk(sup -1) during 15- and 30-day bed rests (BR) maintained upright aerobic capacity (VO₂pk). In the present study, we are evaluating whether aerobic capacity is maintained during a 60-d BR when the LBNPex frequency is reduced to 2-4 sessions (raised dot) wk(sup -1) and resistance exercise (REX) is added 2-3 sessions (raised dot) wk(sup -1). Eight healthy women (32 plus or minus 4 yrs; 56.4 plus or minus 3.6 kg; 164 plus or minus 8 cm; mean plus or minus SD) performed maximal-exertion, graded treadmill tests before and 3 days after a 60-d, 6 deg. head-down tilt BR. (Earliest day the medical monitors would permit a maximal exercise test post-BR). During BR, four subjects performed no exercise (CON), while four other subjects (EX) performed LBNPex and REX on separate days. The LBNPex countermeasure employed an intermittent (40-80% pre-BR VO₂pk), 40-min protocol against an LBNP pressure (-49 plus or minus 3 mmHg) applied to provide a footward force equivalent to 1.0-1.2 body weight. REX consisted of maximal concentric and eccentric supine leg press and heel raise exercises using a gravity-independent flywheel ergometer. Comparisons were performed using paired (within-group) or non-paired (between-group) t-tests. Three days post-BR, VO₂pk of the CON group was reduced significantly from pre-BR (Pre:37.2 plus or minus 1.2, Post: 29.4 plus or minus 2 ml (raised dot) kg(sup -1) (raised dot) min(sup -1), P less than 0.05), while the VO₂pk of the EX group was not significantly reduced (Pre: 39.6 plus or minus 1.9, Post: 38.0 plus or minus 0.6 ml (raised dot) kg(sup -1) (raised dot) min(sup -1)). Peak heart rate, ventilation, rating of perceived exertion, and respiratory exchange ratio were not significantly different between the two groups pre- and post-BR. These preliminary results suggest that the combined LBNPex and REX countermeasures may be sufficient to maintain upright aerobic capacity after long-duration space flights.

Author

Bed Rest; Countermeasures; Lower Body Negative Pressure; Physical Exercise; Treadmills; Resistance

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20080003859 Metrica, Inc., Houston, TX, USA

Multi-Agent System for Managing Human Activities in Space Operations

Schrenkenghost, Debra; Bonasso, R. Peter; March 31, 2006; 7 pp.; In English; IEEE Aerospace Conference, 1 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS9-02060

Report No.(s): IEEEAC Paper-1001, Version 5; Copyright; Avail.: Other Sources

In manned space operations today, the astronauts' activity schedules are preplanned and adjusted daily on Earth. We have developed the Distributed Collaboration and Interaction (DCI) multi-agent system to investigate automating aspects of human activity management. The DCI System assists (1) plan generation, (2) human activity tracking, (3) plan revision, and (4) mixed initiative interaction with the plan. We have deployed and evaluated the DCI system at JSC to assist control engineers in managing anomaly handling activities for automated life support systems. DCI operated round the clock for 20 months in the Water Research Facility at JSC. Using this software, we reduced anomaly response time by engineers from up to 10 hours in previous tests to under an hour. Based on this evaluation, we conclude that agent assistance for schedule management has potential to improve astronaut activity awareness and reduce response time in situations where crew are interrupted to handle anomalies.

Author

Automatic Control; Spacecrews; Crew Procedures (Inflight); Tasks; Scheduling

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*.

20080002946 Army Research Lab., Aberdeen Proving Ground, MD USA

Human Factors Evaluation of the Enhanced Portable Inductive Artillery Fuze Setter (EPIAFS)

Zubal, Orest; Oct 2007; 37 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-6PAH50

Report No.(s): AD-A473942; ARL-MR-0678; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473942>

The enhanced portable inductive artillery fuze setter (EPIAFS) is a product improvement of the portable inductive artillery fuze setter (PIAFS). The EPIAFS was designed to receive data manually and via cable and to inductively set all the fuzes set by the PIAFS and initialize the Excalibur ammunition. The EPIAFS system consists of the platform integration kit (PIK) installed in the howitzer's fire control system, a 15-foot cable to connect the EPIAFS to a PIK receptacle on the howitzer, and the setter which can function in an un-cabled mode, a cabled stand-alone mode, and the cabled mode. EPIAFS is a system that consists of the PIK, cable, and setter. The terms EPIAFS setter and setter are used interchangeably in this report to indicate the portable hand-held portion of the EPIAFS system. Ten male Soldiers, ranging in rank from E1 to E6, arrived at Picatinny Arsenal, New Jersey, to serve as participants in a limited user test to allow for a human factors assessment of the EPIAFS. The testing centered on the ability of the Soldiers to set up the EPIAFS, use the EPIAFS to set inert fuzes, and secure the EPIAFS after use. Soldiers were taken into the outside sunlight and a no-light room to assess their ability to read the un-cabled display of the setter. The Soldiers wore their battle dress uniform (BDU) or modified mission-oriented protective posture (MOPP) equipment, which consisted of their mask and gloves with inserts, for alternating trials. The overall times for the Soldiers to set up the EPIAFS, which consisted of unpacking the EPIAFS and cable and connecting one end of the cable to the howitzer connector and the other end to the EPIAFS, were 0.8 minute in BDUs and 0.9 minute in the modified MOPP equipment. To set the first multi-option fuze, artillery (MOFA) required 5.0 seconds in BDUs and 4.5 seconds in the modified MOPP equipment. To set three more MOFAs required 7.7 seconds in BDUs and 7.9 seconds in the modified MOPP.

DTIC

Artillery; Human Factors Engineering

20080002950 Naval Postgraduate School, Monterey, CA USA

Implementation of the Quantified Judgement Model to Examine the Impact of Human Factors on Marine Corps Distributed Operations

Desmond, Matthew S; Sep 2007; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473950; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473950>

The Distributed Operations (DO) concept is designed to answer the challenge of covert, highly adaptable, enemies operating with a dispersed command structure. The human variance that is part of military combat presents a critical challenge to the USA Marine Corps in the implementation of the DO concept. In addition to all current capabilities a DO Marine unit would have the additional capability of operating in smaller, more autonomous units, and would have greater authority to take actions in a given situation. The domains of Doctrine, Organization, Training, Materiel, Leadership and education, Personnel, Facilities (DOTMLPF) and Human Systems Integration (HSI) are areas where augmentation of current Marine Corps policy could enable Distributed Operations as a capability. This thesis presents a modified form of Dupuy's Quantified Judgment Model (QJM) (1987) called the Predictive Force Ratio Model. It is programmed in Microsoft Excel and first develops a score for a given unit based on physical characteristics pertaining to fire power, then adjusts that score through the use of factor weightings. The model is intended for use by a subject matter expert in estimating the gains that can be achieved in combat power through improvement of a force's human capabilities.

DTIC

Human Factors Engineering; Military Operations

20080003087 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Delft, Netherlands
Technical Evaluation Report

Werkhoven, Peter; Jul 1, 2007; 15 pp.; In English

Report No.(s): AD-A474192; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Education; Military Operations; Simulation

20080003088 Defence Research and Development Canada, Toronto, Ontario Canada

A Review of the Mental Workload Literature

Cain, Brad; Jul 1, 2007; 35 pp.; In English

Report No.(s): AD-A474193; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Mental Health; Mental Performance; Surveys; Workloads (Psychophysiology)

20080003211 Army Research Inst. of Environmental Medicine, Natick, MA USA

Differences in Clothing Insulation Determined with the Parallel and Serial Methods

Xu, Xiaojiang; Endrusick, Thomas; Gonzalez, Julio; Santee, William; Hoyt, Reed; Aug 2007; 5 pp.; In English

Report No.(s): AD-A474465; USARIEM-P07-75; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines the fundamental differences between the parallel and serial methods for calculation of clothing insulation and demonstrates the differences in the insulation values calculated using these two methods. The parallel method is based on the assumption that manikin surface temperatures were uniform (UST) while the serial method is based on the assumption that manikin heat fluxes were uniform (UHF). Eleven clothing ensembles were evaluated on manikins in UST mode. Three of them were further evaluated on manikins in UHF mode. Insulation values were then calculated using both the serial and parallel methods. Results from UST mode showed that the parallel insulations ranged from 1.24 to 5.79 clo while the serial insulations ranged from 1.43 to 7.98 clo. Differences in the parallel and serial insulations increased as the insulation increased, and the serial insulations were approximately 14-38% higher than the parallel insulations. Results from UHF mode showed that the parallel insulations were 1.30 to 5.89 clo and close to the serial insulations of 0.34 to 5.99 clo. In conclusion, only the parallel method should be used when manikins are operated in UST mode and only the serial method should be used when manikins are operated in UHF mode.

DTIC

Clothing; Insulation; Measurement

20080003857 NASA Johnson Space Center, Houston, TX, USA

Nutrition and Exercise in Space and on Earth

Davis-Street, Janis; [2006]; 1 pp.; In English

Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003857>

This presentation in outline format for delivery to school age groups (i.e., K-12) reviews the importance of proper nutrition and exercise for everyone, with emphasis on space travel. It reviews the types of space food, the constraints of eating in space, and some of the challenges of exercising in space. It lists the materials displayed and used as teaching resources, as well as materials to be distributed.

CASI

Education; Nutrition; Physical Exercise; Space Flight Feeding; Nutritional Requirements

20080005209 Technical Cooperation Program, Redstone Arsenal, AL USA

Comparative Assessment of Aircraft-to-Weapon Communication Systems

Dec 1971; 12 pp.; In English

Report No.(s): AD-A474303; RAE-TR-71242; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474303>

Working Group II of Working Panel 0-4 of The Technical Cooperation Program (TTCP) consists of members from the USA, Australia, Canada, and the UK. Working Group II surveyed existing and proposed aircraft-to-weapon fuze selection systems. After a comparative study of the advantages and disadvantages of the various systems, recommendations were made which might influence the design of future aircraft/weapon interfaces. Among these recommendations was the proposal that

consideration might be given to the inclusion of a screened, balanced pair in the standard wiring loom as aircraft development permits. Consideration was given to the following systems: multi-wire systems, direct current/radiofrequency (dc/RF) systems (a basic dc system carrying a RF ripple for selection purposes), dc systems (the basic dc selection system), dc and chopped dc, magnetic aircraft weapon link, digital fuze selection systems, mechanical interconnection analogue systems (systems in which a selector movement in the aircraft is transferred through a mechanical interface to the weapon), and electrical analogue systems (systems in which a selector movement in the aircraft is transferred through an electrical interface to the weapon).

DTIC
Bomber Aircraft; Communication Equipment; Control; Telecommunication; Weapon Systems

20080005210 Army Research Inst. of Environmental Medicine, Natick, MA USA

Effects of an Arctic Ocean Ski Traverse on the Protective Capabilities of Expedition Footwear

Endrusick, Thomas; Frykman, Peter; O'Brien, Catherine; Giblo, Joseph; May 2005; 5 pp.; In English

Report No.(s): AD-A474467; USARIEM-M05-18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A traverse of the Arctic Ocean during a 2000-km unsupported ski expedition provided an opportunity to assess the impact of an extreme cold environment on the protective capabilities of a specialized footwear system (FS). A thermal foot model (TFM) measured thermal resistance (R, m²KW⁻¹) of an FS in new and used conditions. FS consisted of a two-layer sock, a vapor barrier sock, a removable woolen innerboot, a NNN-configured leather/synthetic ski boot, and a waterproof gaiter. When comparing initial total R when dry, the used FS showed an actual increase of 10%. Exposure of the used FS to moisture caused significant reductions in R. Immersing the entire welt of the boot in 8 cm of water for 18 hrs reduced the initial R by a full 34%. Although the used FS had extensive physical wear to the outsole, insole, upper and gaiter, it did not show a reduction in R as a result of the expedition when compared to a new FS. This FS appears to be well chosen as it provided adequate thermal protection to the feet despite exposure to one of the world's most inhospitable climates.

DTIC

Arctic Ocean; Expeditions; Protective Clothing; Skis

20080005211 Army Research Inst. of Environmental Medicine, Natick, MA USA

Evaluation of the Efficiency of Liquid Cooling Garments using a Thermal Manikin

Xu, Xiaojiang; Endrusick, Thomas; Gonzalez, Julio; Laprise, Brad; Teal, Walter; Santee, William; Kolka, Margaret; May 2005; 4 pp.; In English

Report No.(s): AD-A474468; USARIEM-M05-17; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Liquid cooling garments (LCG) absorb heat from both the human body and the environment. The cooling efficiency is influenced by the configurations of the LCG and clothing ensembles worn over the LCG (outer clothing, e.g. personal protective equipment), and environmental conditions. Thermal manikins (TM) have been used to evaluate the performance of LCG systems and to determine the amount of heat that a LCG can extract from a TM. However, effects of the outer clothing's insulation on cooling efficiency have not been investigated. The purpose of this study was to use a TM to investigate the relationship between LCG efficiency, insulation of the outer clothing, and water inlet temperature (Tin).

DTIC

Evaluation; Garments; Liquid Cooling; Protective Clothing; System Effectiveness

20080005212 Army Research Inst. of Environmental Medicine, Natick, MA USA

Simulation of Individual Thermoregulatory Responses to Partial Cold Water Immersion and Exercise

Xu, Xiaojiang; Castellani, John W; Santee, William; Kolka, Margaret; May 2005; 5 pp.; In English

Report No.(s): AD-A474469; USARIEM-M05-22; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During emergencies, adventure racing or military operations, individuals may be partially submerged in cold water, thereby at risk for rapid heat loss and hypothermia. By modeling the effects of water immersion, this hazard may be better understood, and more active preventive measures can be implemented or public warnings issued. The purpose of this study was to determine whether a previously validated cold thermoregulatory model (CTM) for predicting temperature responses in sedentary people during whole body immersion was applicable to partial immersion in cold water during exercise (treadmill walking).

DTIC

Cold Water; Physical Exercise; Physiological Responses; Simulation; Submerging; Temperature Control; Thermoregulation; Water Immersion

20080005213 Army Research Inst. of Environmental Medicine, Natick, MA USA

Noninvasive Warning Indicator of the Red Zone of Potential Thermal Injury and Performance Impairment: A Pilot Study

Yokota, Miyo; Moran, Daniel; Berglund, Larry; Stephenson, Lou; Kolka, Margaret; May 2005; 6 pp.; In English
Report No.(s): AD-A474470; USARIEM-M05-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The guidelines for assessing worker's level of heat strain in order to prevent thermal injury and performance impairment has been widely adapted in industries to promote workers' health and safety. Core temperature (Tcore) is a common physiological parameter used in the guidelines for heat stress; however, measuring Tcore may be invasive and impractical for real time monitoring a worker's health status. This study is a preliminary investigation of non-invasive warning indicator, Red Zone (RZ), for heat strain derived from the combination of heart rate (HR) and skin temperature (Tskin). Individual data from five datasets (Age = 22 plus or minus 5 yrs, BMI = 23.0 plus or minus 2.6, N = 43) were utilized to establish the RZ system. Analysis of the termination points relative to Tskin and HR were identified, along with Body Mass Index for individual differences. The data classified by RZ system were compared to their individual Tcore, using Fisher's exact test. Overall, the data points classified by the RZ system showed relatively good agreement (60-80% probability) with Tcore (p < 0.05). The RZ is a reasonable approach to warn occupational workers that they are approaching or/under thermal strain.

DTIC

Injuries; Temperature Effects; Thermodynamic Properties; Warning Systems

20080005214 Army Research Inst. of Environmental Medicine, Natick, MA USA

Effect of Individual Variability in Body Size on Empirical Model Predictions of Exercise Endurance Times

Blanchard, L A; Wallace, R F; Santee, W R; Berglund, L G; Kolka, M A; May 2005; 5 pp.; In English
Report No.(s): AD-A474471; USARIEM-M05-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Prevention of heat illness is an important part of Army training and doctrine. Heat illness has historically been a substantial problem in military operations and training and continues to affect modern forces, increasing morbidity, mortality, and use of health care resources. If adequate hydration and emergency medical management are not available, many cases of exertional heat illness (EHI) are potentially fatal. Therefore the US military is attempting to minimize the risks to Warfighters through predictive modeling and mission planning. Environmental conditions, clothing worn, and activity level can contribute to excess heat storage making it difficult to maintain thermal balance with the environment. This imbalance can eventually lead to the development of heat illness ranging from relatively minor heat exhaustion to life threatening heat stroke. In addition to weather, clothing, and exertion, increased body mass index (BMI) has recently been shown to increase the likelihood of developing exertional heat illness. USARIEM has developed several models to predict Warfighter performance and requirements. One of these models was retrospectively tested on a database of Marine Corp Recruits to determine how sensitive predictions of exercise endurance time are to individual anthropometric differences.

DTIC

Body Weight; Physical Exercise; Sickesses; Variability

20080005217 Army Research Inst. of Environmental Medicine, Natick, MA USA

Thermal Manikin Evaluation of Passive and Active Cooling Garments to Improve Comfort of Military Body Armor

Endrusick, Thomas; Gonzalez, Julio; Berglund, Larry; Aug 2007; 5 pp.; In English
Report No.(s): AD-A474474; USARIEM-M07-38; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study evaluated two different garments designed to increase ventilation and evaporative cooling under Interceptor Body Armor: a passive, Interceptor Ventilation Vest (IVV); and an active, battery-powered, Body Ventilation System (BVS). Both were tested for thermal (Rt, sq m x C/W) and evaporative resistance (Re, sq m x kPa/W) on a thermal manikin (TM), according to ASTM standards. TM results showed Rt and Re increased (16% and 26%, respectively) when IBA was worn. However, increases were lower (9% and 14%) with IVV under IBA. These lowered resistances increased TM evaporative cooling potential approximately 15%. With the BVS blower unit ON, TM measurements of Rt and Re were lower (17% and 20%), when compared to OFF values. This increased TM evaporative cooling potential approximately 18%. Military use of these garments could allow for increases in sweat evaporation and overall thermal comfort during operational heat exposure.

DTIC

Armor; Clothing; Comfort; Cooling; Evaporation; Evaporative Cooling; Garments; Ventilation

20080005712 Army Research Lab., Aberdeen Proving Ground, MD USA

Usability Assessment of Displays for Dismounted Soldier Applications

Cosenzo, Keryl A; Stafford, Shawn; Dec 2007; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A474924; ARL-TR-4326; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents a usability assessment of scalable displays for dismounted robotic control applications. The assessment covered three components: display size, button features (e.g., size, location), and controllers for tele-operation. Twelve Soldiers participated in the assessment. Before the assessment, the Soldiers were trained on a larger version of the displays. They then used the three scalable display configurations to plan and execute a mission for an unmanned vehicle (UV). During the execution of the task, video was recorded and the experimenters asked scripted questions about the displays. Results showed that the Soldiers were successful in using the various display configurations to complete the UV task; however, all the Soldiers asked clarifying questions about how to plan the mission. These results suggest that the original and largest display design lacked design principles that were fully transferable to smaller displays. With respect to display size and button size, the interviews showed that a small display was preferred to the larger one used in training for dismounted operations. However, the buttons on the small display were difficult to use without a stylus. For mounted operations or during conditions when the Soldier would not have to be mobile, the larger display was preferred. This report discusses these results in detail, related theories, and the implications for designing effective scalable displays.

DTIC

Display Devices; Human Factors Engineering; Teleoperators

20080005713 Army Research Lab., Aberdeen Proving Ground, MD USA

An Investigation of Factors Affecting Multi-Task Performance in an Immersive Environment

Branscome, Teresa A; Grynovicki, Jock O; Dec 2007; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-622716H70

Report No.(s): AD-A474925; ARL-TR-4325; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report presents the results of a study included in a series of investigations designed to increase fundamental knowledge and understanding of the factors affecting multi-task performance in a military environment. In this study, each of 26 civilian and military participants completed a battery of questionnaires designed to gather information about individual differences. Included were a demographics questionnaire; the Zuckerman-Kuhlman Personality Questionnaire Form III; the polychronicity scale; the Dundee Stress State Questionnaire; and the Situational Self-Efficacy scale. The performance component took place in Tactical Environment Simulation Facility (TESF), a controlled laboratory-based research facility. Multi-task performance was evaluated with the use of the Synthetic Work Environment (SYNWORK), a computer-based environment that runs on a personal computer or a laptop (Elsmore, 1994). In addition, a visual target identification scenario was presented in the TESF on a 10- by 12.5-foot rear-projected flat wall display via the DI-Guy(trademark) Scenario. All test participants performed the performance task in each of three conditions: one in which participants performed only the SYNWORK tasks, another in which the SYNWORK memory task was eliminated and the participants were required to simultaneously identify targets on the large screen, and another that required target detection and all SYNWORK tasks. Multivariate analyses conducted on overall task performance measures revealed significant differences between workload levels and experience, and cluster analyses showed significant differences in performance between high and low groups based on mental and physical workload ratings.

DTIC

Cognition; Human Performance; Tasks; Workloads (Psychophysiology)

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*.

20080002983 Naval Postgraduate School, Monterey, CA USA

Integration of Wireless Network Discovery and Exploit Capabilities Within the Constraints of the Joint Threat Warning System (JTWS) Component Architecture and Framework (JCAF)

Spera, Jr, Charles D; Hay, Jonathan M; Sep 2007; 295 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474024; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474024>

In this thesis, we present the integration of IEEE 802.11 wireless network discovery, exploitation, and attack capabilities

into the Joint Threat Warning System (JTWS) Component Architecture and Framework (JCAF). JCAF is the foundation for the Special Operations Command's (SOCOM) platform-independent intelligence gathering and information processing functions. Although the capability to discover, exploit, and attack 802.11 networks already exists elsewhere, there is no common interface for all these functions. This thesis analyzes the feasibility of integrating these capabilities into the JCAF framework by examining the requirements that must be met for incorporation into JCAF. Additionally, this thesis considers design tradeoffs and justifies the decisions that were made. Finally, JCAF is analyzed in terms of its suitability as an architecture for developing platform-independent, distributed systems.

DTIC

Architecture (Computers); Communication Networks; Warning Systems

20080003026 California Univ., Berkeley, CA USA

Modularly Integrated MEMS Technology

Eyoun, Marie-Angie N; May 23, 2006; 183 pp.; In English

Report No.(s): AD-A474116; UCB/EECS-2006-78; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474116>

Process design, development and integration to fabricate reliable MEMS devices on top of VLSI-CMOS electronics without damaging the underlying circuitry have been investigated throughout this dissertation. Experimental and theoretical results that utilize two "Post-CMOS" integration approaches will be presented. The first integration approach uses SiGe MEMS technology for the "Post-CMOS" monolithic integration of the MEMS devices with electronics. Interconnects between SiGe MEMS and Al-TiN metallized layers have been characterized and optimized. A thorough study on Boron doping and Ge content effects on the electrical, mechanical, and chemical properties of SiGe MEMS technology has been performed. Two CMOS compatible micromachining fabrication procedures have been developed for RF and inertial sensing MEMS applications. First, a process flow that uses Ge ashing technique to define nanogaps in SiGe electrostatic MEMS transceivers for wireless communication applications has been demonstrated. Second, a multilayer SiGe MEMS process flow has been implemented for the fabrication of a freely moving disk used to pave the way towards an integrated electrostatically levitated disk sensor system for low loss inertial sensing applications. The sensor system is comprised of a disk-shaped proof-mass that is to be electrostatically suspended between sense and drive electrodes located above, below, and at the sides of the disk. The second "Post-CMOS" integration employs the state-of-art "back-end" materials already available in the integrated circuitry to fabricate the MEMS devices. Copper-based MEMS technology is used for the fabrication of low loss RF MEMS switches directly on top of the electronics. A model accounting for multilayer cantilever beam deflection suitable for MEMS devices fabricated with conventional "back-end" materials was derived. Experimental results char

DTIC

CMOS; Microelectromechanical Systems; Systems Integration

20080003028 Delegation Generale de l'Armement, Issy-les-Moulineaux, France

Application of the Semantics Enrichment Concept in the Information Fusion for Command Support

Bares, Michel; Dec 1, 2006; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474120; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474120>

No abstract available

Decision Making; Enrichment; Semantics

20080003178 Naval Postgraduate School, Monterey, CA USA

An Analysis of IEEE 802.16 and WiMAX Multicast Delivery

Staub, Patrick A; Sep 2007; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474400; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Broadband and wireless have enjoyed a massive mass market adoption in the past twenty years. Users want to be able to enjoy all applications, including multimedia, voice, and data, while still being able to access them in a mobile and fixed environment. Multicasting is a tool used in networking which allows for transmitting information to a select group of users and is especially useful for time-sensitive data which can be very large in terms of bandwidth. Current technologies, including WiFi, have difficulty handling such applications because they were not designed to handle multi-service flows concurrently. IEEE 802.16 and its emerging WiMAX technology will enable that sort of uncompromised data transmission in a wireless environment. WiMAX was designed primarily for that reason: to deliver different types of data simultaneously in fixed and

mobile environments at broadband levels and ranges only dreamed of. The analysis described in this thesis will focus on the design of WiMAX, specifically the MAC layer and describe how its features are better suited for multicasting than WiFi. Additional goals will be to look at potential applications and services of WiMAX in the telecommunications industry.

DTIC

Broadcasting; Data Transmission

20080003186 Naval Postgraduate School, Monterey, CA USA

Implementing Simulation Design of Experiments and Remote Execution on a High Performance Computing Cluster

Peters, Adam J; Sep 2007; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474411; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis focused on creating an object-oriented software architecture around which tools can be created to increase the usability of stochastic simulations such as IWARS and Pythagoras on high performance computing clusters. The objective of the architecture was to enable the user to design and execute simulation experiments using a platform-independent client and server to create a common interface for various simulations. The interface input is used to select the experimental factors of interest to the research analyst and then to create the scenario files for each simulation run with minimal human intervention. To develop the architecture the current state of the art was explored, a proposed process flow was developed. This process flow was then vetted by operations researchers from several organizations. A prototype application was developed based on the software architecture. The prototype revealed great benefit in this type of tool.

DTIC

Architecture (Computers); Experiment Design; Object-Oriented Programming; Simulation

20080005260 Michigan Univ., Ann Arbor, MI USA

Mixed-Initiative Development of Plans With Expressive Temporal Constraints

Pollack, Martha E; Jun 14, 2007; 16 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0043

Report No.(s): AD-A474565; F009940-047252-FINAL; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474565>

The overall objective of this project was the development of methods for efficiently finding solutions to problems that consist of sets of expressive constraints including both overconstrained and underconstrained situations. In either case, constraint management is necessary: in an overconstrained situation, it is necessary to determine how best to relax existing constraints so that a solution can be computed, while in an underconstrained situation, it is necessary to select good (or, if time permits, optimal) solutions from amongst the alternatives. We developed novel and highly efficient solutions using two classes of techniques: fully automatic techniques that manage constraint sets given explicit preference functions, and mixed initiative techniques that allow interactive control by a human user to manage constraint sets, and we evaluated these on both synthetic and real-world data sets.

DTIC

Artificial Intelligence; Computer Programming; Optimization

20080005348 Air Force Research Lab., Hanscom AFB, MA USA

Quantum Algorithms for Computational Physics: Volume 3 of Lattice Gas Dynamics

Yepez, Jeffrey; Jan 3, 2007; 315 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A474659; AFRL-VS-HA-TR-2006-1143; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is divided into two tracks, an introductory track and a technical track. The introductory track includes a general introduction and background, introductions to two types of analog (and parallel) quantum computing, and an overview oriented conclusion. The technical track includes sections on quantum memory, conservative quantum logic, and quantum algorithm types, including quantum algorithms for the Dirac and Schrodinger quantum mechanical wave equations, the mesoscopic scale quantum Boltzmann equation, and the quantum algorithms for the diffusion equation, Burgers equation, magnetohydrodynamic Burgers equations, and the Navier-Stokes fluid equation.

DTIC

Algorithms; Gas Dynamics; Lattice Vibrations

20080006311 Carnegie-Mellon Univ., Pittsburgh, PA USA

Evaluating a Service-Oriented Architecture

Blanco, Phil; Kotermanski, Rick; Merson, Paulo; Sep 2007; 91 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A475194; CMU/SEI-2007-TR-01; ESC-TR-2007-015; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The emergence of service-oriented architecture (SOA) as an approach for integrating applications that expose services presents many new challenges to organizations resulting in significant risks to their business. Particularly important among those risks are failures to effectively address quality attribute requirements such as performance, availability, security, and modifiability. Because the risk and impact of SOA are distributed and pervasive across applications, it is critical to perform an architecture evaluation early in the software life cycle. This report contains technical information about SOA design considerations and tradeoffs that can help the architecture evaluator to identify and mitigate risks in a timely and effective manner. The report provides an overview of SOA, outlines key architecture approaches and their effect on quality attributes, establishes an organized collection of design-related questions that an architecture evaluator may use to analyze the ability of the architecture to meet quality requirements, and provides a brief sample evaluation.

DTIC

Architecture (Computers); Evaluation; Quality Control; Service Oriented Architecture; System Effectiveness

61

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.

20080002924 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Soesterberg, Netherlands

Tussenrapportage Validatie Onderwijsvernieuwingen (Validation Assistant in Instructional Design)

van Meer, J P; Veldhuis, G J; van Emmerik, M L; van Schaik, M G; May 2007; 41 pp.; In Dutch

Report No.(s): AD-A473898; TNO-DV-2007-A111; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473898>

The purpose of this article is to introduce and demonstrate an effective tool that supports instructors in developing educational programs for training and instruction. Due to periodical job rotation within the military, instructional developers are not always experts in their field and are consequently unaware of the types of educational concepts that are available to teach with. This supportive tool has been developed over the course of several years, incorporating both theoretical and practical criteria related to selecting a suitable concept for an educational program. It aims to support instructors in selecting suitable educational concepts for their specific needs. Subsequently, it provides support in the actual concretization of the concepts. In continuance of two pilots, the tool has been tested by 29 instructors in training. This demonstrates very high potential for the use of the tool. It can be concluded that, with some refinements, it is well adapt at providing support for the development of new educational programs.

DTIC

Computer Techniques; Education

20080002944 Army Research Lab., Adelphi, MD USA

Computer Models of the Human Body Signature for Sensing Through the Wall Radar Applications

Dogaru, Traian; Nguyen, Lam; Le, Calvin; Sep 2007; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473937; ARL-TR-4290; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473937>

This technical report presents numerical simulations of the human body radar signature, with application to sensing through the wall (STTW) scenarios. We utilize the Finite Difference Time Domain (FDTD) modeling technique to compute the electromagnetic scattering from realistic human body models. We analyze the radar cross section (RCS) of the human body in different configurations as a function of aspect angle, frequency, and polarization, drawing important conclusions in terms of the magnitude, variability, and statistics of the human radar signature. We also use the modeling data in order to simulate the operation of a low frequency, ultra-wideband (UWB) synthetic aperture radar (SAR), by creating SAR images of the

human body in various configurations. The results obtained in this study can be used as guidance by radar system designers in order to optimize performance in the context of a STTW scenario.

DTIC

Computerized Simulation; Detection; Human Body; Radar Signatures; Signatures; Walls

20080002949 Army Research Lab., Aberdeen Proving Ground, MD USA

Real-Time News Analysis (RTNA) Scraper Assessment

Slocum, Christine E; Brodeen, Ann E; Sep 2007; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473948; ARL-TN-295; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473948>

An assessment was conducted to evaluate the performance of the Real-Time News Analysis Scraper application used to extract article body text from online news sources. The application's performance was evaluated by determining the integrity of scraped text outputted, a metric found by calculating the output's similarity to text manually selected from the same articles by a human control group. Levenshtein's edit-distance algorithm was implemented to calculate normalized similarity scores of each scraped and manually selected article text pair; normalized scores were direct indicators of integrity. The Scraper was found to perform unacceptably overall because the majority of scraped articles experienced integrity loss exceeding the established threshold. Results of the assessment were insufficiently detailed to give causal explanations for the Scraper's observed performance. Recommendations were not made for the application's improvement; however, a protocol was outlined in detail for a follow-on assessment.

DTIC

Computer Techniques; Losses; On-Line Systems; Pattern Recognition; Real Time Operation; Scrapers

20080002964 Carnegie-Mellon Univ., Pittsburgh, PA USA

COTS and Reusable Software Management Planning: A Template for Life-Cycle Management

Anderson, William; Morris, Ed; Smith, Dennis; Ward, Mary C; Oct 2007; 155 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A473976; CMU/SEI-2007-TR-011; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473976>

The acquisition community needs guidance in long-term management planning for selecting, approving, and upgrading software products, especially commercial off-the-shelf (COTS) and other reusable software products. As the mixture of these components in systems increases, the demand for a planned way to manage them continues to grow. The COTS and Reusable Software Management Plan (CRSMP) can facilitate acquisition programs management of COTS and other reusable software products. The CRSMP provides a strategy outline for managing data about component licensing, tracking release schedules, monitoring software interdependencies, choosing specific features and extensions and documenting those choices, and evaluating and mitigating risks associated with deploying COTS and other reusable software components in a system. The CRSMP presented in this report can serve as a guide for how to manage multiple COTS and other reusable software components in complex systems.

DTIC

Computer Programs; Life (Durability); Systems Management; Templates

20080002967 Naval Postgraduate School, Monterey, CA USA

Extending DoD Modeling and Simulation with Web 2.0, Ajax and X3D

Farias, Michael; Sep 2007; 227 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473985; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473985>

DoD has much to gain from open source Web 2.0 and Ajax Applications. The Java language has come a long way in providing real world case studies and scalable solutions for the enterprise that are currently in production on sites such as eBay.com (<http://www.ebay.com>) and MLB.com (<http://www.mlb.com>). The most popular Ajax application in production is Google Maps (<http://maps.google.com>), which serves as a good example of the power of the technology. Open Source technology has matured greatly in the past three years and is now mature enough for deployment within DoD systems. In the past, management within the DoD has been reluctant to consider Enterprise Level Open Source Technologies as a solution in the fear that they might receive little to no support. In fact, the Open Source Business Model is entirely based on first

developing a broad user base then providing support as a service for their clients. DoD Modeling and Simulation can create dynamic and compelling content that is ready for the challenges of the 21st century and completely integrated with the GIG (Global Information Grid) concept. This paper goes over a short history of MVC (Model View Controller Architectures) and goes over various pros and cons of each framework (Struts, Spring, Java Server Faces) which is critical for the deployment of a modern Java Web Application. Ajax and various frameworks are then discussed (Dojo, Google Web Toolkit (GWT), ZK, and Echo2). The paper then touches on Ajax3D technologies and the use of Rez to generate simple 3D models of entire cities and goes on to discuss possible extended functionality of the Rez concept to create a terrain system like Google Earth in X3D.

DTIC

Architecture (Computers); Internets; Models; Security; Simulation; Websites

20080002981 Florida Univ., Gainesville, FL USA

An Adaptive Planning Framework for Situation Assessment and Decision-Making on an Autonomous Ground Vehicle

Touchton, Robert A; Jan 2006; 166 pp.; In English

Report No.(s): AD-A474020; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474020>

The primary contribution of this research is the design, implementation, and field testing of an Adaptive Planning Framework 'APF' that can address the problem of autonomous operation in a complex, unstructured environment. It encapsulates a new and unique approach to dynamic situation assessment, behavior management, and decision-making. This research also included a literature review and development of a Reference Implementation. The thesis behind this research is that a well-organized, three-stage process of 1) understanding the current situation, 2) understanding the suitability and viability of the available behaviors in light of that situation, and 3) providing the capability to autonomously make and execute behavior-related decisions, all in real-time, provides new levels of intelligence to autonomous ground vehicles (AGV). This research was performed using the resources of the UF Center for Intelligent Machines and Robotics. This environment provided the ability to collaboratively explore engineering alternatives, create experimental software, and test it in a real-world setting, ultimately leading to the creation of the Reference Implementation. All this was aimed at validating the thesis of the research and producing a more robust APF, operationally proven in a representative physical environment. The Adaptive Planning Framework has been shown to be both a viable method for representing and managing complex, situation-dependent behavior on an AGV and a valuable contribution to researchers tasked with developing and fielding such a vehicle. The viability of the architecture and design was demonstrated by the development and testing of the Reference Implementation.

DTIC

Autonomous Navigation; Autonomy; Decision Making; Situational Awareness; Virtual Reality

20080002989 California Univ., Berkeley, CA USA

Standby Power Management Architecture for Deep-Submicron Systems

Sheets, Michael A; May 19, 2006; 147 pp.; In English

Report No.(s): AD-A474033; UCB/EECS-2006-70; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474033>

In deep-submicron processes a significant portion of the power budget is lost in standby power due to increasing leakage effects. For systems that have long idle times punctuated by bursts of activity, such as PDAs, cell-phones, and wireless sensor networks nodes, this standby power consumption reduces the effectiveness of duty-cycling. This work surveys a number of subthreshold leakage reduction techniques and identifies supply rail gating 'MTCMOS' as the most promising. MTCMOS is a dynamic technique that has two distinct modes: an active processing mode and a lower power sleep mode. The smallest area implementations of MTCMOS have the side-effect of losing the state of the system when in sleep mode. This complicates the resumption of the active mode, because traditional designs are intolerant to the loss of state. This work presents a general framework to reduce the state maintenance requirements during sleep mode without losing information required to resume the active mode. The framework is applied to finite state machines and microprocessors, since these are commonly used in system design. Partitioning the system into subsystems with individually controlled supply rails 'termed power domains' allows fine-grain control of the power mode for portions of the chip. Each power domain must be dynamically put in the appropriate power mode to ensure correct system operation while minimizing power consumption. This control logic collectively forms the core of a power manager. Most power manager implementation approaches are largely ad-hoc and custom designed for each application. This work presents a structured methodology and architecture for the implementation and control of power domains to form a power managed system. Approaches to the partitioning and implementation of

individual power domains are explored. The functional requirements for the power manager
DTIC

Architecture (Computers); Communication Networks; Radiotelephones

20080002992 California Univ., Berkeley, CA USA

Compile-Time Schedulability Analysis of Communicating Concurrent Programs

Liu, Cong; Jun 28, 2006; 112 pp.; In English

Report No.(s): AD-A474040; UCB/EECS-2006-94; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474040>

The use of concurrent models has become a necessity in embedded system design. This trend is driven by the growing complexity and inherent multitasking of embedded systems. Describing a system as a set of concurrently executed, relatively simple subtasks is more natural than using a single, complicated task. Embedded systems, however, have limited resources. They often have a few processors. This implies that several software subtasks 'programs' have to share a CPU. Compile-time scheduling determines a sequential execution order of the program statements that satisfies certain constraint, e.g. bounded memory usage, at compile time. We study compile-time schedulability of concurrent programs based on a Petri net model. We consider concurrent programs that asynchronously communicate with each other and the environment through unbounded first-in first-out 'FIFO' buffers. The Petri net represents the control flow and communications of the programs, and models data dependent branches as non-deterministic free choices. A schedule of a Petri net represents a set of firing sequences that can be infinitely repeated within a bounded state space, regardless of the outcomes of the nondeterministic choices. Schedulability analysis for a given Petri net answers the question whether a valid schedule exists in the reachability space of this net. Due to the heuristics nature of existing scheduling algorithms, discovering powerful necessary condition for schedulability is important to gain efficiency in analysis. We propose a novel structural approach to schedulability analysis of Petri nets. Structural analysis often yields polynomial-time algorithms and is applicable for all initial states. We show that unschedulability can be caused by a structural relation among transitions modelling nondeterministic choices. Two methods for checking the existence of the relation are propo

DTIC

Communicating; Interprocessor Communication; Scheduling

20080002995 Naval Postgraduate School, Monterey, CA USA

Automatic Web-based Calibration of Network-Capable Shipboard Sensors

Le, Charles K; Sep 2007; 135 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474046; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474046>

This thesis investigates the feasibility of developing an automatic web-based sensor calibration system with four main objectives. The first objective was to reduce the number of personnel required to calibrate shipboard sensors. The second was to reduce the time required to complete the calibration process. The third was to develop a platform independent and user-friendly interface using the web browser. The fourth was to allow operators to calibrate the sensors remotely from thousands of miles away. This was achieved by using the commercial off the shelf (COTS) products, developing in-house hardware, setting up a web server and developing numerous software programs in Labview and Java languages to allow operators to remotely monitor, and control the calibration process. All communication and control algorithms are handled by two computers. One serves as a web server, equipped with java codes and web pages to interface with an operator. The other serves as a data collector. It collects data from all sensors via the network, passes these data to the web server computer and then to the operator's web browser. It also runs a calibration algorithm on a selected sensor as requested by the user. The two computers communicate with one another via the ship's LAN using UDP packets.

DTIC

Calibrating; Computer Programs

20080003034 California Univ., Berkeley, CA USA

Joint Entropy Minimization for Learning in Nonparametric Framework

Ahammad, Parvez; Jun 9, 2006; 42 pp.; In English

Report No.(s): AD-A474139; UCB/EECS-2006-85; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474139>

No abstract available

Entropy; Learning; Optimization

20080003105 Missouri Univ., Saint Louis, MO USA

Wavelet Approach to Data Analysis, Manipulation, Compression, and Communication

Chui, Charles K; Aug 7, 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0298

Report No.(s): AD-A474239; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The main objective of our research program over the past three-year period is three-fold: firstly, mathematical theories and methods, as well as construction of basis functions, for multi-level approximation and analysis, with emphasis on scattered data interpolation and representation, were developed; secondly, based on minimum-energy criteria, new data processing tools, particularly variational algorithms and optimal wavelet thresholding methods, with applications to image restoration, were introduced; and finally, these developments were applied to data representation, manipulation, rendering, and communication, as well as to solutions of various specific problems in computer graphics. In particular, the standard approach to subdivision schemes by constructing templates of scalar values is extended to matrix-valued subdivisions to gain flexibility and smaller template sizes for the main purpose of achieving twice continuously differentiable surfaces with more desirable geometric shapes and arbitrary topologies. As a result, one-ring templates for interpolating surface subdivisions are introduced in this project, for a wide range of applications, including reversed engineering, surface interpolation of medical and geospatial data, and visualization of point clouds. The theories and methods developed in this project have also been applied to designing algorithms for various applications in computer graphics, including adaptive stroke-based sketching with editing features, non-photo realistic graphic drawings, rendering and animation, as well as wavelet-based digital image restoration.

DTIC

Data Processing; Interprocessor Communication; Manipulators; Wavelet Analysis

20080003127 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands

Softwaremodule voor het Simuleren van de Gevolgen van Raketonderschepping (The Dutch Program for the Simulation of Missile Intercept Effects)

Sterkenburg, E Abadjieva; P; Bouquet, F; Doup, P W; Jul 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474298; TNO-DV-2007-A257; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A national program in The Netherlands on Joint Air Defence (JAD) includes the development of a chain of models called HAPPIE (Hazard Area Prediction by Perturbations in Ensembles). It simulates ballistic missile intercepts and the consequence effects on the ground. The hazard area is calculated as a function of the ATP-45 compliant MW (Missile Intercept Report), CDR (Chemical Downwind Report) and BWR (Basic Wind Report) messages. The program will be used for both real-time warning purposes and for JAD planning purposes, to optimize the configuration in the battle field of the air defence weapon systems. HAPPIE will be extended with several new sub-models, describing the debris behavior and the drop break-up at altitudes above 200 km after an intercept. This paper aims to provide an overview of the physical models which describe the chemical agents' behaviour during descending after an intercept.

DTIC

Antimissile Defense; Ballistic Missiles; Computerized Simulation; Hazards; Interception; Missiles; Simulation

20080003168 Naval Postgraduate School, Monterey, CA USA

Predicting Host Level Reachability via Static Analysis of Routing Protocol Configuration

McManus, Jr, Stephen; Sep 2007; 167 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474384; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Static analysis refers to techniques that extract and check the semantics of a program entirely from examining its source code. In this case, router configuration files can be thought of as the source code of a distributed program whose execution determines the host level reachability of the network. Static analysis brings about new challenges. Unlike a regular computer program, router configuration commands hide the detailed logic of routing protocols. Completely constructing the logic for static analysis of router configuration files is difficult and even impossible in some cases where the network has a large number of concurrently running routing processes distributed over many routers and variable network delays make the interactions between these processes too complex to understand exactly. This research takes an initial step in understanding the power of static analysis. A system is built to infer the packet forwarding table of each router from the router configuration files. The scope of the work is confined to networks where OSPF is used exclusively for routing. The system is able to infer the exact forwarding tables of the Cisco routers for several lab test networks.

DTIC

Coding; Computer Programs; Predictions; Protocol (Computers); Static Tests

20080003177 Kent Univ., Canterbury, UK

International Conference on Artificial Immune Systems (1st) ICARIS 2002, held on 9, 10, and 11 September 2002

Mar 7, 2002; 230 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F61775-02-WF057

Report No.(s): AD-A474399; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document is the final proceedings for the International Conference on Artificial Immune Systems (1st), ICARIS 2002, held 9-11 Sep 2002.

DTIC

Artificial Intelligence; Conferences; Detection; Immune Systems; Warning Systems

20080003180 Naval Postgraduate School, Monterey, CA USA

Experimentation and Evaluation of IPV6 Secure Neighbor Discovery Protocol

Pohl, Marcin; Sep 2007; 103 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The DoD is expected to transition to IPv6 networking within the next few years. The IPv6 Neighbor Discovery Protocol is responsible for autoconfiguration and neighbor address resolution which establishes hosts on the network and allows communication between hosts. IPsec, the default security mechanism for IPv6, does not allow for automatic protection of the autoconfiguration process. Thus, the Secure Neighbor Discovery Protocol (SeND) was created. SeND uses Cryptographically Generated Addresses (CGA) and asymmetric cryptography as a first line of defense against attacks on integrity and identity. It claims to achieve mutual authentication of hosts and routers without the need for a Certification Authority (CA). This thesis evaluates this claim by building a test-bed of SeND enabled hosts. The major findings include: (i) that SeND does not really offer mutual authentication without a CA; (ii) using computationally intensive cryptography as the first line of defense allows CPU exhaustion attacks.

DTIC

Protocol (Computers); Security

20080003181 Naval Postgraduate School, Monterey, CA USA

Built-In-Test Equipment for Integrated Weapons Systems: Achieving Utility and User Acceptance

Previsich, Nicholas; Sep 2007; 65 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474403; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this work was to determine whether a direct statistical or stochastic relationship between the following systemic characteristics of dedicated built-in-test-equipment (BITE) could be derived and quantified: annual maintenance costs, user acceptance, operational availability, and complexity (defined as total number of sensor interfaces per system). Three systems of ascending degrees of complexity from the USAF F-15A/BC/D, O/A-10A, and C-5A/B/C were analyzed, and based upon raw data acquired from field operating units and fleet-wide maintenance data collection a model was constructed to derive constraints on a postulated best-fit interdependence between these four characteristics. The chief finding was that BITE reliability and minimal intrinsic system maintenance burden were the prime determinants of user acceptance and therefore system success. A corollary finding was that the number of data interfaces (or sensors) was mathematically irrelevant to user acceptance, suggesting that condition-based monitoring schemas are feasible provided that BITE system-level reliability is maximized with a minimal maintenance burden placed on the user community. Sensor redundancy to achieve this goal was the suggested method. This model may be used as an objective criterion for evaluating future BITE system procurement proposals, a critical concern for the emerging predictive/condition-based maintenance paradigms currently favored by the Department of Defense, NASA, and other Federal and commercial agencies.

DTIC

Systems Integration; User Requirements; Weapon Systems

20080003202 Academy of Sciences (Russia), Moscow, Russian Federation

Materials and Coatings for Extreme Performances: Investigations, Applications, Ecologically Safe Technologies for Their Production and Utilization

Nov 16, 2004; 590 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8655-04-1-5008

Report No.(s): AD-A474445; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Final Proceedings for Materials and Coatings for Extreme Performance: Investigations, Applications, Ecologically

Safe Technologies for Their Production and Utilization, 13 September 2004 - 17 September 2004 Principles of designing materials and coatings for operation in hazard conditions; Scientific fundamentals and computer models for the processes of manufacturing materials and coatings for operation in hazard conditions; Advanced technologies for production and joining materials and products for operation in hazard conditions; Structure and properties of materials and coatings for operation in hazard conditions; Experimental data obtained from performance of materials and coatings in on location hazard conditions; Potential and contemporary technologies for recycling industrial waste aimed to production structural, heat-insulative, facing and other materials.

DTIC

Computerized Simulation; Hazards

20080003208 Naval Postgraduate School, Monterey, CA USA

Software Defined Radio Design for Synchronization of 802.11A Receiver

Sanfuentes, Juan L; Sep 2007; 102 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474460; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Constant improvements in techniques applied to different radio communication system stages, including coding, modulation, synchronization and security, make any implementation quickly obsolete. On the other hand, different communication standards used among military and public safety agencies make difficult the necessary interoperability. These reasons force users to replace equipment frequently, increasing cost and implementation time. Software Defined Radios (SDRs), partly implemented in software, can solve these problems, making full use of programmable modules. This thesis presents an implementation of the necessary algorithms that solve the synchronization requirements of IEEE 802.11a WLAN receivers. This is a continuation of a previous thesis effort, where the post-synchronization steps of the receiver were addressed. The software utilized for this purpose is the Open Source SCA Implementation::Embedded (OSSIE), developed by Virginia Tech. Each algorithm was created as a different component, allowing reuse and modularity for the development of future waveforms.

DTIC

Computer Programs; Radio Equipment; Receivers; Synchronism; Telecommunication

20080003334 Air Force Research Lab., Eglin AFB, FL USA

Single Sensor Scheduling for Multi-Site Surveillance

Jeffcoat, David E; Yavuz, Mesut; Nov 2007; 26 pp.; In English

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A474426; AFRL-RW-EG-TP-2007-7419; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper is concerned with scheduling a single sensor to visit a number of sites with possibly time-variant dynamics. The paper motivates and presents a mathematical model for a sensor scheduling problem arising in the context of military operations research. The contributions made in the paper include the development and comparison of both deterministic and stochastic sensor scheduling methods. Results obtained in the paper show that the proposed heuristic methods can be used in real-time. A computational study is also provided. A deterministic greedy method produces the lowest cost solutions among the heuristics tested. The greedy methods produce the most predictable schedules, while the stochastic methods produce solutions that are less predictable in terms of site revisit times.

DTIC

Mathematical Models; Scheduling; Surveillance

20080003358 Advantech, Inc., Annapolis, MD USA

ARN Integrated Retail Module (IRM) & 3D Whole Body Scanner System at Fort Carson, Colorado

Perrin, Richard A; Bona, Robert E; Brekhus, Bennis A; Fraser, Carol E; Dec 2006; 143 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): SPO103-02-D-0018; SPO103-02-D-0020

Report No.(s): AD-A474423; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This project is a joint research implementation and evaluation effort of AdvanTech Inc. and Human Solutions using 3D Whole Body Scanning technology. The project involved 4 principal tasks: 1) Implement the ARN Integrated Retail Module (IRM); 2) Implement the 3D Whole Body Scanner; 3) Integrate 3D Whole Body scanning technology with the ARN Integrated Retail Module (IRM) for clothing issue at the Central Issue Facility (CIF) Ft. Carson CO; and 4) Develop and validate

dynamic local tariffs. The main goals of the ARN 3D scanning research initiative at the Ft. Carson CIF were: (1) Establish base-line information for future contracting and manufacture of uniforms; (2) Identify the correct uniform sizes required to reduce stock levels and overall efficiency and (3) Enhance operations and the effectiveness for the OCIE supply chain, and reduce coats in the overall process.

DTIC

Clothing; Sizing (Shaping)

20080003785 Institute for Human Factors TNO, Soesterberg, Netherlands

Presence

den Dekker, Erik; Delleman, Nico; Jul 1, 2007; 17 pp.; In English

Report No.(s): AD-A474136; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474136>

No abstract available

Virtual Reality; Human Performance; Computerized Simulation

20080005228 Naval Postgraduate School, Monterey, CA USA

Assessing Server Fault Tolerance and Disaster Recovery Implementation in Thin Client Architectures

Slaydon, Samuel L; Sep 2007; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474496; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis will focus on assessing server fault tolerance and disaster recovery procedures for thin-clients being implemented in smart classrooms and computer laboratories aboard the Naval Postgraduate School campus. The successful discovery of fault tolerance limits and a disaster recovery plan not only benefits the Naval Postgraduate School (NPS), but also provides the same for other commands that have implemented or plan to employ thin clients as part of their Information Technology (IT) infrastructure. Since the backbone of thin client/server-based computing (TCSBC) is the reliance on the server as the hub of processing power and data storage, it is imperative that some plan to restore the server be effected to save from the loss of valuable data. In the case of NPS, the absence of the main server not only contributes to data loss, but deprives students of hours of invaluable classroom instruction. The fault tolerance issues and disaster recovery solutions addressed in this thesis may not be suitable in all thin client architectures, but perhaps the knowledge gained can aid some commands in avoiding a catastrophic server failure.

DTIC

Architecture (Computers); Computer Networks; Disasters; Fault Tolerance

20080005261 Bolt, Beranek, and Newman, Inc., Arlington, VA USA

Integration of Enhanced Propagation, Environmental Variability, and Network Performance Models into the InfraMAP Software Toolkit

Norris, David; Gibson, Robert; Nov 2007; 69 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DTRA01-00-C-0063; Proj-CD

Report No.(s): AD-A474567; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474567>

Enhancements to the infrasound software tool kit, InfraMAP, have been integrated in three main areas: propagation modeling, environmental variability modeling, and stochastic localization techniques. All new model functionality is included in a next-generation release of the tool kit. The modeling advances improve propagation predictions and understanding of environmental effects, and they have been used to evaluate the localization performance and confidence bounds of operational infrasonic networks. New propagation modeling features include a high altitude, low frequency absorption model, a synthetic waveform generator from ray tracing, and an improved Parabolic Equation (PE) propagation algorithm. In environmental variability, a range-dependent spectral gravity wave model has been developed that generates wind perturbation fields for use in evaluating propagation variability. Finally, regional infrasound networks can be defined and used to compute source localizations and associated areas of uncertainty, based upon both measurement data and modeling results.

DTIC

Infrasonic Frequencies; Performance Prediction; Software Development Tools; Variability

20080005338 Signal Innovations Group, Inc., Durham, NC USA

The Use of SIG Algorithms in Sea Tests

Carin, Lawrence; Rabenold, Patrick; Nov 28, 2007; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-C-0026

Report No.(s): AD-A474616; CDRL-A004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report summarizes recent progress by Signal Innovations Group (SIG) in supporting the Naval Research Laboratory (NRL) on the development and application of mine identification algorithms using a Low Frequency Broadband (LFBB) sonar system. SIG has the tasks of developing the algorithms and transitioning them to NRL for use in sea tests. Fully-transitioned algorithms have performed well in sea tests, with additional development increasing the computational efficiency. The discussion below provides a summary of the following items: the Kernel Matching Pursuits (KMP) classification algorithm, the correlation kernel method, and sample results from an NRL sea test.

DTIC

Algorithms; Computer Programming; Seas; Software Engineering; Sonar

20080005343 Science Applications International Corp., McLean, VA USA

Software Test Report for the Network Monitoring and Management Hybrid MANET Dynamic Addressing

Sutkoff, David; McElwee, Jerilyn; Gaspard, Brad; Jul 24, 2007; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N0014-04-C-0179

Report No.(s): AD-A474627; SAIC-HMDA-STR-01-U-R0C1; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this applied research project was to create a service that allows mobile nodes in a hybrid MANET to receive global Internet Protocol IP addresses from the appropriate mobile gateway without requiring user configuration. A MANET is a mobile ad-hoc network communicating via wireless links. A hybrid MANET adds one or more gateway nodes (e.g. nodes providing connectivity to other networks via satellite or other links). A Hybrid MANET Dynamic Addressing (HMDA) service was developed which provides a method for gateway discovery and dynamic global IP address configuration of mobile nodes. This service will allow mobile nodes to roam seamlessly from one area to another providing continuous communications throughout all network merges and partitions. SAIC has successfully implemented and demonstrated the Network Monitoring and Management Hybrid MANET Dynamic Addressing service that meets or exceeds the requirements and objectives set forth by ONR. The HMDA service was demonstrated using two gateways and six mobile nodes distributed across two subnets. Since positive test results were obtained, it is recommended to transition this methodology from the lab environment to an operational scenario.

DTIC

Computer Programs; Internets; Networks; Project Management; Tests

20080005345 Old Dominion Univ., Norfolk, VA USA

Crowd Modeling in Military Simulations: Requirements Analysis, Survey, and Design Study

Petty, Mikel D; Gaskins, Ryland C; McKenzie, Frederic D; Apr 2003; 73 pp.; In English

Contract(s)/Grant(s): N00014-97-D-2051; Proj-0476

Report No.(s): AD-A474641; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report provides a comprehensive requirements analysis, literature survey, and engineering design study of crowd modeling in military simulations. This report has five main sections. An introductory section is followed by a brief overview of the research effort, with descriptions of the project motivation, history, and methodology. An analysis of requirements for crowd modeling in military simulations is detailed. Following that, a survey of the state of the art in psychological and computational models of crowd behavior is presented. Then a design study of a crowd simulation federate, which is based in part on a set of implementation experiments, is reported. Finally, a statement of findings and recommended research concludes the primary content of the report. The appendices of this report include a list of references, a list of acronyms and abbreviations, a partial list of sources for the requirements analysis process, and brief biographies of the authors.

DTIC

Crowding; Group Dynamics; Simulation; Surveys

20080005384 University of Southern California, Marina del Rey, CA USA

2002 Defense Modeling and Simulation Office (DMSO) Laboratory for Human Behavior Model Interchange Standards

Lent, Michael van; Hill, Randall; McAlinden, Ryan; Brobst, Paul; Jul 2003; 55 pp.; In English

Contract(s)/Grant(s): NAWC-TSD-BAA-2.3.2; Proj-0476

Report No.(s): AD-A474724; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the effort to address the following research objective: 'To begin to define, prototype, and demonstrate an interchange standard among Human Behavior Modeling (HEM) -related models in the Department of Defense (DoD), Industry, Academia, and other Government simulations by establishing a Laboratory for the Study of Human Behavior Representation Interchange Standard.' With experience, expertise, and technologies of the commercial computer game industry, the academic research community, and DoD simulation developers, the Institute for Creative Technologies discusses their design and implementation for a prototype HBM interface standard and also describes their demonstration of that standard in a game-based simulation environment that combines HBM models from the entertainment industry and academic researchers.

DTIC

Human Behavior; Models; Simulation

20080005394 Army Engineer Research and Development Center, Vicksburg, MS USA

Yuma Proving Ground GEM-3-E Data Collection

Bennett, Jr, Hollis H; DeMoss, Tere A; Fields, Morris P; Goodson, Ricky a; Hahn, Charles D; Morgan, John C; Nov 2007; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474759; ERDC/EL-TR-07-28; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report documents the performance and operational capabilities of the GEM-3 system for the Advanced UXO Detection/Discrimination Technology Demonstration at the U.S. Army Yuma Proving Ground (YPG), Yuma, AZ. The data collection effort was conducted under the Department of the Army Research and Development DOBE4 (BA4) Technical Demonstration Program. Data analysis was conducted under the Department of the Army Research and Development DOE3 (BA3) Program. The objective was to evaluate the enhancements made to the GEM-3 system. Post-demonstration analysis focused on the functionality of the sensor system, the evaluation of the noise level of the data collected, improvements in target detection and discrimination, and positioning accuracy of the system. The stability of the system was evaluated through histograms and statistical analysis of data collected during the technology demonstration. Based on findings of the characteristics of the collected data and initial work performed on target detection and discrimination, target detection and discrimination techniques were applied and evaluated.

DTIC

Data Acquisition; Data Processing

20080005689 Maryland Univ., College Park, MD USA

Multiscale Hierarchical Decomposition of Images with Applications to Deblurring, Denoising and Segmentation

Tadmor, Eitan; Nezzar, Suzanne; Vese, Luminita; Nov 4, 2007; 28 pp.; In English

Contract(s)/Grant(s): N00014-91-J-1076; DMS07-07949

Report No.(s): AD-A474869; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We extend the ideas introduced in [TNV04] for hierarchical multiscale decompositions of images. Viewed as a function f of 2D space, a given image is hierarchically decomposed into the sum or product of simpler 'atoms' u_k , where u_k extracts a more refined information from the previous scale u_{k-1} . To this end, the u_k 's are obtained as dyadically scaled minimizers of standard functionals arising in image analysis. Thus, starting with $v_{-1} := f$ and letting v_k denote the residual at a given dyadic scale, $k \geq 0$, then the recursive step $[u_k, v_k] = \arg \min_{u,v} \{ \langle u, v \rangle + T(u) \}$ leads to the desired hierarchical decomposition, $f = \sum_{k=0}^{\infty} u_k$; here T is a blurring operator. We characterize such u_k -minimizers 'by duality' and expand our previous energy estimates of the data f in terms of u_k . Numerical results illustrate applications of the new hierarchical multiscale decomposition for blurry images, images with additive and multiplicative noise and image segmentation.

DTIC

Decomposition; Focusing; Hierarchies; Image Processing; Numerical Analysis; Segments

20080005699 California Univ., Davis, CA USA

Runtime Support for Type-Safe Dynamic Java Classes

Malabarba, Scott; Pandey, Raju; Gragg, Jeff; Barr, Earl; Barnes, J F; Jan 2000; 35 pp.; In English

Contract(s)/Grant(s): F30602-97-1-0221

Report No.(s): AD-A474895; TR-CSE-2000-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Modern software must evolve in response to changing conditions. In the most widely used programming environments, code is static and cannot change at runtime. This poses problems for applications, that have limited down-time. More support is needed for dynamic evolution. In this paper we present an approach for supporting dynamic evolution of Java programs. In this approach, Java programs can evolve by changing their components, namely classes, during their execution. Changes in a class lead to changes in the its instances, thereby allowing evolution of both code and state. The approach promotes compatibility with existing Java applications, and maintains the security and type safety controls imposed by Java's dynamic linking mechanism. Experimental analyses of our implementation indicate that the implementation imposes a moderate performance penalty relative to the unmodified virtual machine.

DTIC

Computer Programming; Java (Programming Language)

20080005704 Naval Research Lab., Bay Saint Louis, MS USA

Makef15: An ADCIRC Model Fort.15 Input File Creation GUI for Parameter Specification and Periodic Boundary Forcing

Blain, Cheryl A; Linzell, Robert S; Dec 7, 2007; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474911; NRL/MR/7320-07-9081; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The User's Manual for the Makef15 Graphical User Interface (GUI) software, makefort15gui.pl, contains descriptions of the software, including its functionality and usage. The Makef15 GUI is a window-based, platform-independent Perl script that can both create or modify the ADvanced CIRCulation (ADCIRC) Model Parameter and Periodic Boundary Forcing File (fort.15). The software was developed for ADCIRC versions 45.11.

DTIC

Boundaries; Graphical User Interface

20080005845 National Defense Univ., Washington, DC USA

Dragnet: A Case Study of the CLEAR System

Musa, Samuel; Keegan, Matt; Kyser, Giles; Jan 2007; 17 pp.; In English

Report No.(s): AD-A474910; NDU/CTNSP-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The opening narration of Dragnet, the long running TV series about two Los Angeles cops, could not be a more fitting way to open a case study on the Chicago Police Department's (CPD) Citizen and Law Enforcement Analysis Reporting System (CLEAR) and its dramatic journey into the Department of Defense (DOD). The quickest way to describe CLEAR is to mention a quote from Ron Huberman, assistant deputy superintendent, Office of Information and Strategic Services at CPD 'CLEAR automates everything we do in the [Chicago] police department, from personnel management to detailed field incident reports. It includes the entire arrest and booking process: taking offenders into custody, mug shots, everything. CLEAR places it all in one integrated platform. It's enabled us to become a completely paperless police department...All information will be in the hands of the officers, making them better equipped to protect our communities.' This study focuses on the problem of how to enhance the situational awareness (SA) of a young soldier or marine manning a checkpoint in Iraq and how information technology (IT) might be used to help him/her better understand the regional demographic, thereby increasing the number of bad guys caught. The IT in question is CLEAR, a commercial-off-the-shelf (COTS) tool developed to assist the beat cop in the arrest and bookings process. CLEAR provides a rapid and accurate assessment of an individual's information based on rudimentary biometric triggers that drive the correlation of data in an advanced data-mining tool. Data collected at the beat cop level populates a growing data universe and also drives mapping overlay capability at higher headquarters, which can be used to enable real-time, 24/7 force development decisions. Such capabilities have obvious potential for military use.

DTIC

Law (Jurisprudence); Security; Software Development Tools

20080006088 Reactive Systems, Inc., Falls Church, VA USA

A Software Hub for High Assurance Model-Driven Development and Analysis

Cleaveland, Rance; Sims, Steve; Hansel, David; DuVarney, Dan; Jan 23, 2007; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-M-0145

Report No.(s): AD-A474972; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474972>

This final report describes the results of a Phase I SBIR research project sponsored at Reactive Systems Inc. by the Office of Secretary of Defense, with oversight provided by the Office of Naval Research. The goal of the project was to conduct a feasibility study for a so-called software hub that is intended to promote interoperability among software modeling and analysis tools. As part of this six-month effort a translator was implemented from the commercially popular modeling notations Simulink/Stateflow into the SAL input notation for the SALSA analysis tool, and several experiments conducted that demonstrated the utility of applying SALSA-style analyses to Simulink/Stateflow models. A preliminary design of a software hub was also developed.

DTIC

Computer Programming; Hubs; Software Engineering

20080006094 Delft Hydraulics Lab., Netherlands

Modeling of Mud-Wave Interaction: Mud-Induced Wave Transport & Wave-Induced Mud Transport

Winterwerp, Johan C; Nov 2007; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0484

Report No.(s): AD-A474984; Z3672; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474984>

This report describes the set-up and mathematical-physical formulations of a model simulating the interaction between soft mud deposits and waves. This model presumes a two-layer schematization, the lower layer consisting of liquefiable mud of high density and viscosity, and the upper layer of low viscous water. From an analytical solution of the 2L schematization the dispersion relation for the wave propagation and attenuation is derived, which can be re-written in the form of an energy dissipation term, implemented in SWAN (Delft3D-wave). Next, the radiation stresses are elaborated and added to the 2L schematization to account for wave-induced mud transport. Also a new rheological model has been proposed to describe liquefaction of soft mud by waves, and the subsequent strength recovery after the passage of the waves. A scheme is presented on how to implement these formulations in Delft3D.

DTIC

Damping; Deposits; Mud; Wave Interaction

20080006123 Army Research Lab., Aberdeen Proving Ground, MD USA

Motion Detection in the Far Peripheral Vision Field

Monaco, William A; Kalb, Joel T; Johnson, Chris A; Dec 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-62716AH70

Report No.(s): AD-A475034; ARL-MR-0684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475034>

Our objectives were to apply Bayesian threshold estimation procedures and new technology to the determination of motion detection (angular velocity) and to determine whether threshold measures, combined with large screen technology and specialized software, could be used to evaluate human motion sensitivity in the far peripheral visual field beyond 50 degrees radius. With the use of the Parameter Estimation by Sequential Testing threshold estimation procedure, black dot targets were presented at 53.4, 72.6, and 90 degrees eccentricity in the temporal visual field of two subjects who had normal visual function. Motion detection thresholds demonstrated a systematic increase with increasing visual field eccentricity and could be obtained within 10 stimulus trials. The average angular velocity motion thresholds were approximately 0.5 degree per second for the 54.3-degree eccentricity, 1.2 to 1.5 degrees per second for the 72.6-degree eccentricity, and 2.1 degrees per second for the 90-degree eccentricity. Our findings indicate that it is possible to obtain motion detection (displacement) thresholds in the far peripheral visual field using Bayesian threshold estimation procedures. In view of the importance of motion detection in the periphery for stimulus localization, attentional demands, orientation and mobility tasks, this procedure may have significant applications for many military visual tasks.

DTIC

Computer Programs; Detection; Far Fields; Motion; Peripheral Vision

20080006134 Army Research Lab., Adelphi, MD USA

An Overview of ARL's Multimodal Signatures Database and Web Interface

Bennett, Kelly; Wen, Sam; Robertson, James; Dec 2007; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A475054; ARL-TR-4337; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: <http://hdl.handle.net/100.2/ADA475054>

The U.S. Army Research Laboratory (ARL) Multimodal Signatures Database (MMSDB) is a centralized collection of sensor data of various modalities that are co-located and co-registered. The signatures include ground and air vehicles, personnel, mortar, artillery, small arms gunfire from potential sniper weapons, explosives, and many other high value targets. This data is made available to Department of Defense (DoD) and DoD contractors, Intel Agencies, other government agencies (OGA) and academia for use in developing target detection, tracking, and classification algorithms and systems to protect our Soldiers. A platform independent Web interface disseminates the signatures to researchers and engineers within the scientific community. Hierarchical Data Format 5 (HDF5) signature models provide an excellent solution for the sharing of complex multimodal signature data for algorithmic development and database requirements. Many open source tools for viewing and plotting HDF5 signatures are available over the Web. Future development includes extending the Web interface into a portal system for accessing ARL algorithms and signatures and High Performance Computing (HPC) resources.

DTIC

Data Bases; Internets; Signal Processing; Signatures

20080006296 Carnegie-Mellon Univ., Pittsburgh, PA USA

CMMI (Trademark) for Acquisition, Version 1.2

Nov 2007; 441 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A475159; CMU/SEI-2007-TR-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The CMMI-ACQ, V1.2 model is a collection of best practices that is generated from the CMMI V1.2 Architecture and Framework. This collection includes acquisition best practices from government and industry. CMMI-ACQ is based on the CMMI Model Foundation or CMF (i.e., model components common to all CMMI models and constellations), the CMMI Acquisition Module [Bernard 2005], and the Software Acquisition Capability Maturity Model (SA-CMM) [SEI 2002]. CMMI-ACQ also incorporates work by several acquisition organizations to adapt the Development constellation for use in an acquisition organization.

DTIC

Acquisition; Systems Engineering

20080006301 Carnegie-Mellon Univ., Pittsburgh, PA USA

Software-Intensive Systems Productivity: A Vision and Roadmap (v 0.1)

Campbell, Grady; Dec 2007; 61 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A475166; CMU/SEI-2007-TN-017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Software-Intensive Systems Producibility Initiative (<http://www.sei.cmu.edu/sispi>) has been proposed to foster a program of technology research and transition that will improve producibility in the acquisition/development and sustainment/evolution of software-intensive systems (SiS). This document is a draft in progress of a technology vision and roadmap to improve the ability of the DoD and industry to deliver needed SiS capability in a timely, cost-effective, and predictable manner. The goal at this stage is to establish the general concepts and approach for a producibility initiative and to stimulate discussion of these ideas and the research and transition efforts needed to achieve enhanced producibility in practice. The roadmap is meant to serve as a coherent evolving framework for defining and prioritizing potential research investments and technology transition efforts related to producibility. A roadmap has three elements: a representation of the current situation, a vision that characterizes an improved situation, and a plan of action for transitioning from the current to the improved situation. This roadmap identifies five research themes, two transition themes, and an approach to measuring effectiveness for an initiative focused on achieving a vision of enhanced SiS producibility.

DTIC

Computer Programming; Software Engineering

20080006309 Scripps Institution of Oceanography, La Jolla, CA USA

Beaked Whale Anatomy, Field Studies and Habitat Modeling

Hildebrand, John A; Nov 2007; 43 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00244-06-C-0030

Report No.(s): AD-A475190; NPS-OC-07-009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes the results of two tasks related to the study of beaked whales. The first study was a field study of beaked whales in the Gulf of California from December 2004 to December 2006. The goal of the study was to determine the range of sound produced by beaked whales and to investigate beaked whale behavior and habitat. A minimum of 17 cetacean species (12 toothed and 5 baleen whales) were observed in 147 sightings. The proportion of sighted toothed whales and baleen whales was 67% and 32%, respectively. The second task was the modeling of beaked whale anatomy, the conversion of anatomy to physical properties, and the use of these in a finite element model of the effects of intense sound. To validate their methodological procedures, the authors compared CT data from live, frozen, and thawed specimens of *Tursiops truncatus*. The results showed that CT scans produce similar results in tissues and organs for the following quantities: geometry, absolute density, and sound velocity across live and thawed specimens. Simulated sound sources placed inside and outside of a modeled adult male beaked whale (*Ziphius cavirostris*) revealed pathways for acoustic propagation into and out of the head. This result supports the notion that dual sonar sources interfere constructively to form a sonar beam in front of the animal. The simulations also indicated a new 'gular pathway' for sound reception. Propagated sound pressure waves enter the head from below and between the lower jaws, continuing toward the bony ear complexes through the internal mandibular fat bodies. The report titles produced through these studies are as follows: 'Vocalizations and Marine Habitat of Baleen and Beaked Whales,' by Gustavo Cardenas, Jorge Urban, and Alejandro Gomez-Gallardo; and 'Simulated Sound Transmission and Reception in Cuvier's Beaked Whale (*Ziphius Cavirostris*) Using the Vibro-Acoustic Toolbox,' by Ted W. Cranford, Petr Krysl, and John A. Hildebrand.

DTIC

Anatomy; Habitats; Sound Transmission; Whales

20080006315 Army Tank-Automotive Research and Development Command, Warren, MI USA

Warfighter-in-the-Loop Experiments with GT-DRIVE and SimCreator

McGough, Matt; Nov 13, 2007; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475207; No Copyright; Avail.: Defense Technical Information Center (DTIC)

OUTLINE: * Motivation - Hybrid Electric Vehicle Evaluation and Assessment Program; * TARDEC Duty Cycle Experiment Process (DCE-TOP) - Warfighter-in-the-Loop; * TARDEC GT-Drive Conv. and Hybrid HMMWV Models; * SimCreator Vehicle Dynamics Model; * GT-Drive / SimCreator Integration; * DCE-TOP Results; * Conclusion.

DTIC

Computerized Simulation; Electric Motor Vehicles; Military Personnel

20080006349 Army Construction Engineering Research Lab., Champaign, IL USA

Facility Composer (Trademark) and PACES (Trademark) Integration: Development of an XML Interface Based on Industry Foundation Classes

Nachtigall, Susan D; Brucker, Beth A; Nov 2007; 129 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DACA42-01-P-00037; DACA42-02-P-0156

Report No.(s): AD-A475289; ERDC/CERL TR-07-46; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Architectural Engineering and Construction (AEC) industry has made substantial effort over the past several years to create a standard facility modeling format that better enables their different software applications to work together. This emerging standard, known as the Industry Foundation Class (IFC), is being developed by the International Alliance for Interoperability (IAI) and can be found in recent releases of commercial AEC software. With the evolution of this facility modeling standard, it is becoming possible to capture criteria and requirements during planning and design, and to reuse these data during the life cycle of the facility. The Engineer Research and Development Center, Construction Engineering Research Laboratory is currently developing a set of facility architectural programming tools, called Facility Composer[TradeMark] (FC). FC supports the capture and tracking of facility criteria and requirements during planning charrettes, which are key to capturing the stakeholders requirements in the early phases of project development. As the facility program, criteria, and requirements are chosen, these tools populate the IFC object model. This model can then be used for downstream analyses such as cost, sustainability, and physical security. As the model matures, it can be used for the facility's life cycle.

DTIC

Computer Aided Design; Document Markup Languages; Industries

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.

20080002962 Naval Postgraduate School, Monterey, CA USA

Improving Automated Lexical and Discourse Analysis of Online Chat Dialog

Forsyth, Eric N; Sep 2007; 127 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473971; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473971>

One of the goals of natural language processing (NLP) systems is determining the meaning of what is being transmitted. Although much work has been accomplished in traditional written and spoken language domains, little has been performed in the newer computer-mediated communication domain enabled by the Internet, to include text-based chat. This is due in part to the fact that there are no annotated chat corpora available to the broader research community. The purpose of our research is to build a chat corpus, initially tagged with lexical and discourse information. Such a corpus could be used to develop stochastic NLP applications that perform tasks such as conversation thread topic detection, author profiling, entity identification, and social network analysis. During the course of our research, we preserved 477,835 chat posts and associated user profiles in an XML format for future investigation. We privacy-masked 10,567 of those posts and part-of-speech tagged a total of 45,068 tokens. Using the Penn Treebank and annotated chat data, we achieved part-of-speech tagging accuracy of 90.8%. We also annotated each of the privacy-masked corpus's 10,567 posts with a chat dialog act. Using a neural network with 23 input features, we achieved 83.2% dialog act classification accuracy.

DTIC

Algorithms; Internets; Interprocessor Communication; Linguistics; Marking; Natural Language Processing

20080002986 Naval Postgraduate School, Monterey, CA USA

Multiple Assets Position Determination in a 3-Dimensional Environment Using the APRS Protocol

Fourtzitzis, Evangelos K; Sep 2007; 119 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474028>

Increased situational awareness in the battlefield is one of the main objectives in today's operations and applies to all levels of commands. Several attempts have been made to use tracking devices for detecting and continuously updating the positional data of friendly assets on a map. Current applications like Falcon View fulfill their objective in presenting the location of targets of interest on a digital mapping environment. Falcon View is a geographic information system (GIS) used extensively by DoD for mission planning purposes. When the requirement is to track airborne assets such as aircraft or unmanned aerial vehicles (UAVs), none of the current applications can present the results in three-dimensions. Instead they project the received tracks on the ground in 2-dimensions creating a false or impaired perspective of the true tactical situation. This thesis develops and tests a software application in a plug-in form integrated into the open-source NASA World Wind mapping engine. The application is designed to determine the tracks of both airborne and groundmoving assets in three dimensions. It also tests the concept in a real-world environment and verify the impact it has on situational awareness at various command levels.

DTIC

Military Operations; Protocol (Computers)

20080002988 California Univ., Berkeley, CA USA

Closing the Loop: Control and Robot Navigation in Wireless Sensor Networks

Schaffert, Shawn M; Sep 5, 2006; 140 pp.; In English

Contract(s)/Grant(s): F33615-01-C-1895

Report No.(s): AD-A474032; UCB/EECS-2006-112; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474032>

Wireless sensor networks have received considerable attention for their potential as a cheap, easily deployed, distributed monitoring tool. Recently, researchers have begun to investigate the use of wireless sensor networks to drive closed-loop control systems. However, such composite systems are nontrivial to design due to the system interface dichotomy: control systems typically assume periodic, high frequency sensor updates whereas sensor networks provide a periodic, low frequency, and laggy sensor updates. Utilizing robot navigation and pursuit-evasion games as benchmarks, our research focuses on

improving control system performance by exploiting the properties of wireless sensor networks. We developed and deployed a real-world, medium-scale wireless sensor network for playing pursuit-evasion games. Using our experience from this deployment, we highlight the difficulties in using sensor network data to accurately localize robots. Several techniques designed to compensate for such difficulties are developed and incorporated into an unified system architecture. To test our architecture, an application-level simulator, accounting for many of the sensor network characteristics that frustrate control design, is developed. This simulator allows us to identify components of our system architecture that can improve the performance of control systems operating in networks of sensors. Amongst the components, intelligent path planning is identified as uniquely important in improving robot localization accuracy during navigation. Path planning techniques that use information maps, exploiting the knowledge of node topology and sensor models, are developed. Information is a metric for measuring the ability of a region in the environment to aid in robot localization.

DTIC

Navigation; Navigation Instruments; Networks; Radiotelephones; Robot Sensors; Robots

20080003008 California Univ., Berkeley, CA USA

Implementation of a Localization System for Sensor Networks

Karalar, Tufan C; Karalar, Tufan C; May 18, 2006; 175 pp.; In English

Report No.(s): AD-A474072; UCB/EECS-2006-69; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474072>

Localization is very important for self-configuring wireless sensor networks. There are two main tasks to performing localization. Assuming availability of reference points, first the relationships to the reference points are established; in this thesis this relationship is the distance to the reference point. Second, using the reference point positions and the relations to these points, an algorithmic computation is carried out to compute the position. In the existing body of research on sensor network localization, the algorithmic aspects of this final position calculation have received the most attention. However there remain significant implementation issues related to both distance measurements and algorithmic computations. In this thesis the implementation issues regarding a sensor network localization system is studied along with some examples. In the first half, the implementation of a distributed, least-squares-based localization algorithm is presented. Low power and energy dissipation are key requirements for sensor networks. An ultra-low-power and dedicated hardware implementation of the localization system is presented. The cost of fixed-point implementation is also investigated. The design is implemented in a 0.13 μ m CMOS process. It dissipates 1.7mW of active power and 0.122nJ/op of active energy with a silicon area of 0.55mm². The mean calculated location error due to fixed-point implementation is shown to be 6%. In the second part, a radio frequency 'RF' signal based Time of Flight 'ToF' measuring ranging system for wireless sensor networks is proposed, designed and prototyped. The prototype measurement error is within -0.5m to 2m while operating at 100Msps sampling rate and using a 50MHz signal in the 2.4GHz ISM band. The system accuracy is limited by the sampling rate and can be linearly improved with increasing rates. This RF method is more co

DTIC

Networks; Position (Location); Radiotelephones

20080003029 California Univ., Berkeley, CA USA

Effect of Slow Fading and Adaptive Modulation on TCP/UDP Performance of High-Speed Packet Wireless Networks

Dong, Xuanming; Aug 25, 2006; 142 pp.; In English

Report No.(s): AD-A474121; UCB/EECS-2006-109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474121>

High speed data wireless networks in multipath environments suffer channel impairment from many sources such as thermal noise, path loss, shadowing, and fading. In particular, short-term fading caused by mobility imposes irreducible error floor bounds on system performance. We study the effect of fading on the performance of the widely used TCP/UDP protocol, and investigate how to improve TCP performance over fading channels. Our solutions target upcoming mobile wireless systems such as IEEE 802.16e wireless MANs 'Metropolitan Area Networks' where adaptive modulation is enabled and the underlying medium access scheme is On-Demand Time Division Multiple Access 'On-Demand TDMA'. Adaptive modulation is used in the new generation of wireless systems to increase the system throughput and significantly improve spectral efficiency by matching parameters of the physical layer to the time-varying fading channels. Most high-rate applications for such wireless systems rely on the reliable service provided by TCP protocol. The effect of adaptive modulation on TCP throughput is investigated. A semi-Markov chain model for TCP congestion/flow control behavior and a multi-state Markov chain model for Rayleigh fading channels are used together to derive the steady state throughput of TCP Tahoe and Reno. The theoretical prediction based on our analysis is consistent with simulation results using the network simulator NS2. The

analytical and simulation results triggered the idea of cross-layer TCP protocol design for single-user scenarios. The fading parameters of wireless channels detected in the physical layer can be used to dynamically tune the parameters 'such as packet length and advertised receiver window size' of the TCP protocol in the transport layer so that TCP throughput is improved. For multi-user scenarios, we study how multi-user diversity can be used to improve th

DTIC

Fading; High Speed; Modulation; Protocol (Computers); Radiotelephones

20080003085 State Univ. of New York, Buffalo, NY USA

Service-Oriented Architectures, Network-Centric Warfare, and Agile, Self-Synchronized C2: Impacts to Data Fusion Process Design

Llinas, James; Dec 1, 2006; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474190; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Command and Control; Multisensor Fusion; Service Oriented Architecture; Synchronism; Warfare

20080003156 Naval Postgraduate School, Monterey, CA USA

Refinement Composition Using Doubly Labeled Transition Graphs

Martinsen, Thor; Sep 2007; 77 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474356; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Process Algebra forms a cornerstone in the formal methods area of Computer Science. Among the more widely used approaches is Milner's Communication and Concurrency Systems (CCS). Recently CCS has been extended by Schmidt and Bibighaus through the introduction of Doubly Labeled Transition Systems. This framework has enhanced the model's ability to capture security and availability properties. In this thesis we reformulate, simplify, and extend Bibighaus work using a graph theoretic framework. The intent is that this abstract mathematical view will make the results more accessible and stimulate additional research. Existing definitions and theorems are redefined and proved using Labeled and Doubly Labeled Transition Graphs (LTG and DLTG). CCS simulation concepts are recast as graph morphisms and the notion of abstraction and refinement are explained through the use of graphs. Bibighaus work is extended by showing how to carry out non-atomic DLTG refinement, and by developing a form of graph composition involving graph refinements that share a common abstract graph. This type of composition is proven to always be possible with DLTG refinements, and we demonstrate that the composite graph is both a refinement of the abstract graph, and an abstract graph for the refinements from which it was made.

DTIC

Computer Graphics; Telecommunication

20080003188 Naval Postgraduate School, Monterey, CA USA

Automated Alerting for Black Hole Routing

Puri, Vinay; Sep 2007; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474419; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Distributed/Denial of Service (DIDoS) attacks are the most common and easy-to-launch attacks against a computer or network. Once a DIDoS attack is recognized, there are several methods available to mitigate its impact. One of the methods is to drop the attacker's traffic at the edge of the network via Null Routing-also called Black Hole Routing (BHR). BHR is more efficient than the creation and processing of access control lists. Prior work has validated the effectiveness of BHR in mitigating DIDoS attacks in a setting where the defense is activated manually. This research built upon that work and developed a proof-of-concept automated BHR process integrated with Snort, an open source Intrusion Detection System (IDS), to facilitate a faster reaction to a DIDoS attack. A real test bed consisting of Cisco routers was created to evaluate the performance of the developed system. The results demonstrated that the automation of BHR is both possible and desirable in mitigating DIDoS attacks.

DTIC

Black Holes (Astronomy); Detection; Warning Systems

20080003360 Naval Postgraduate School, Monterey, CA USA

Joint Mobile Network Operations: Routing Design and Quality of Service Configuration

Norton, David K; Sep 2007; 153 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474387; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Current inter-Service military networking is inefficient and lacks the desired level of Joint interoperability. Generally, the

different Service branches build stove-piped networks that do not allow sharing of resources with the other branches. This approach is taken because the individual networks do not see the benefits of interconnectivity as worth the effort required to build secure, stable, and operationally effective network solutions. The Joint Mobile Network Operations (JMNO) project seeks standard solutions to the networking challenges of tactical military units. Through the publication of these standards, the intent is to reduce the complexity of finding networking solutions. This, in turn, reduces the perceived cost of inter-Service networking, making it more attractive to military units. This thesis provides some specific solutions that can be included in the JMNO standards. It examines network routing and provides recommendations for protocol selection and configuration. It also recommends implementing certain Quality of Service (QoS) controls to make more efficient use of available bandwidth, to provide preferred handling of critical time-sensitive traffic, and to provide individual networks a means of protecting their links from misuse by mobile units.

DTIC

Communication Networks; Mobile Communication Systems; Military Operations

20080005687 National Geospatial-Intelligence Agency, Reston, VA USA

Session Initiation Protocol Network Encryption Device Plain Text Domain Discovery Service

Robson, Christopher L; Dec 7, 2007; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 55-9118-B-7

Report No.(s): AD-A474867; NRL/FR/5591--07-10-156; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report provides a method for cryptographic isolated domains to discover other cryptographic isolated domains by using the IETF Session Initiation Protocol (SIP). This method, called the SIP Network Encryption Device Plain Text Domain Discovery Service (SIP-DS), will not require a new IETF standard or any modification to existing IETF standards, nor are any specifically configured infrastructure or network devices required. This discovery method allows any encryption device, be it typical U.S. government Type I encryption devices such as TACLANE, HAIPE, or FASTLANE, or any non-government cryptographic devices implementing this technology, to find and exchange plain text domain (PTD) information. Additionally, SIP-DS will allow one encryption device to proxy PTD information for other encryption devices unable to implement this method.

DTIC

Cryptography; Protocol (Computers); Texts; Wide Area Networks

20080005709 Norwegian Defence Research Establishment, Kjeller, Norway

Improving Efficiency and Simplicity of Tor Circuit Establishment and Hidden Services

Oeverlier, Lasse; Syverson, Paul; Jun 2007; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474921; XB-NRL/ITD/5500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we demonstrate how to reduce the overhead and delay of circuit establishment in the Tor anonymizing network by using pre-distributed Diffie-Hellman values. We eliminate the use of RSA encryption and decryption from circuit setup, and we reduce the number of DH exponentiations vs. the current Tor circuit setup protocol while maintaining immediate forward secrecy. We also describe savings that can be obtained by precomputing during idle cycles values that can be determined before the protocol starts. We introduce the distinction of eventual vs. immediate forward secrecy and present protocols that illustrate the distinction. These protocols are even more efficient in communication and computation than the one we primarily propose, but they provide only eventual forward secrecy. We describe how to reduce the overhead and the complexity of hidden server connections by using our DH-values to implement valet nodes and eliminate the need for rendezvous points as they exist today. We also discuss the security of the new elements and an analysis of efficiency improvements.

DTIC

Circuits

20080005809 Northrop Grumman Corp., Columbus, GA USA

Techniques and Practices in the Training of Digital Operator Skills

Leibrecht, Bruce C; Goodwin, Gregory A; Wampler, Richard L; Dyer, Jean L; Sep 2007; 68 pp.; In English

Contract(s)/Grant(s): W74V8H-04-D-0045-0008; Proj-A790

Report No.(s): AD-A474556; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474556>

This report presents research on classroom training practices in Army Battle Command System courses. The investigation

examined a sample of institutional courses using observation and classification techniques. Three learning theories--behaviorist, cognitive, and constructivist--guided the collection and analysis of data. Cognitive and behaviorist training techniques were observed somewhat more frequently than constructivist techniques. The frequency of training techniques depended on the type of course (operator vs. leader orientation), instructor style, and progression across days. The discussion offers potential improvements in the areas of training techniques, program of instruction, training environment, and instructional innovation. The report is intended for use by training designers and developers, digital trainers, and training managers working in institutional settings.

DTIC

Digital Systems; Education; Procedures

20080005829 Air War Coll., Maxwell AFB, AL USA

Air Force and the Cyberspace Mission: Defending the Air Force's Computer Network in the Future

Courville, Shane P; Dec 2007; 59 pp.; In English

Report No.(s): AD-A474828; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A little over year ago, in November 2005, the Secretary of the Air Force Michael W. Wynne and Air Force Chief of Staff General T. Michael Moseley wrote a joint letter to all airmen of the Air Force, which defined a new mission statement that included the concept of 'cyberspace.' Cyberspace was defined as including network security, data transmission, and the sharing of information. Although the Air Force and the Department of Defense (DoD) in general, have numerous safeguards in effect to protect systems and their networks, DoD relies on a system that is 'passive' when encountering cyber threats. This paper recommends that the Air Force pursue research in quantum encryption and security, and continue to examine computer security techniques for the mid-term and beyond. The Air Force should continue future planning efforts to anticipate and develop countermeasures to emerging threats in order to proactively protect and dominate the cyberspace domain of the future. This paper argues that America's future adversaries can, and will, use information technology as a means to wage warfare in the cyberspace domain against the USA. The Air Force is highly dependent on computers and information operations, and will be even more dependent in the next 20 years. The majority of computers, their operating systems, and software purchased by the Air Force are commercial off-the-shelf (COTS) components, often manufactured abroad due to cheaper cost. Thus, foreign countries could place hidden components inside the computers, making the computers vulnerable for attack and/or spying. Furthermore, Air Force networks are connected to and utilize the internet, which also is vulnerable for exploitation.

DTIC

Communication Networks; Computer Information Security; Computer Networks; Protection; Vulnerability

20080006101 Cornell Univ., Ithaca, NY USA

An Improved Testbed for Highly-Scalable Mission-Critical Information Systems

Van Renesse, Robbert; Nov 5, 2007; 7 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0283

Report No.(s): AD-A474999; CU-49738; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474999>

Network Emulation Testbeds are highly important resources to Computer Science research and to training students in the field of scalable network infrastructures. The Cornell DURIP cluster is anticipated to increase in usage over the next several years to include more members of the Systems groups here at Cornell University. We also anticipate a greater interaction with our colleagues at AFRL in Rome, NY. For this purpose we have upgraded the cluster so that it can run the Emulab software, to support 1 Gbit networking, and to include 32 additional nodes.

DTIC

Computer Networks; Information Systems

20080006299 Carnegie-Mellon Univ., Pittsburgh, PA USA

Flow Latency Analysis with the Architecture Analysis & Design Language (AADL)

Feiler, Peter; Hansson, Jorgen; Jun 2007; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A475162; CMU/SEI-2007-TN-010; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Control system components are sensitive to the end-to-end latency and age of signal data. They are also affected by variation (jitter) in latency and age values due to different runtime configurations (i.e., sampling or data-driven signal

processing pipelines, dissimilar communication mechanisms, partitioned architectures, and globally synchronous versus asynchronous hardware). This technical note introduces an analysis framework designed to calculate the end-to-end latency and age of signal stream data as well as their jitter. The latency analysis framework and calculations are illustrated in the context of an example model that uses the flow specification notation of the Architecture Analysis & Design Language (AADL). The report describes how this latency analysis capability can be used to determine worst-case end-to-end latency on system models of different fidelity and how it accounts for partitioned architectures. It also summarizes the worst-case end-to-end flow latency analysis capability provided by the Open Source AADL Tool Environment (OSATE) flow latency analysis plug-in.

DTIC

Programming Languages; Systems Engineering

20080006307 Carnegie-Mellon Univ., Pittsburgh, PA USA

SCAMPI Lead Appraiser (Service Mark) Body of Knowledge (SLA BOK)

Masters, Steve; Behrens, Sandi; Mogilensky, Judah; Ryan, Charlie; Oct 2007; 119 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A475183; CMU/SEI-2007-TR-019; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Standard CMMI Appraisal Method for Process Improvement (SCAMPI) is designed to provide benchmark quality ratings relative to Capability Maturity Model Integration (CMMI) models. The role of the SCAMPI Lead Appraiser, who conducts the SCAMPI process, has developed into a distinct profession that encompasses a wide and deep array of competencies. The SCAMPI Lead Appraiser Body of Knowledge (SLA BOK) provides a multi-dimensional view of the competencies and associated skills that are needed to be a successful SCAMPI Lead Appraiser. The SLA BOK is a driver for the SEI Appraisal Program's approach to ensure quality of SCAMPI appraisals. It establishes a comprehensive basis for curriculum, training, certification, observation, and quality assurance programs.

DTIC

Knowledge Based Systems; Quality Control

63

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*.

20080003030 Stottler Henke Associates, Inc., San Mateo, CA USA

Integrating Intelligent Structured Training with a Virtual Dismounted Environment

Jensen, Randy; Tasoluk, Coskun; Marshall, Henry; Sims, Jason; Green, Gary; Jan 2007; 14 pp.; In English

Report No.(s): AD-A474132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474132>

The advancing state of the art in dismounted embedded training makes use of helmet-mounted displays, manwearable computers, and other immersive hardware to construct increasingly engaging environments. Within such a frame work, structured training methods provide a means to achieve learning objectives and concept retention, with minimal instructor involvement. Intelligent structured training applies real-time automated evaluation and feedback methods based on Intelligent Tutoring Systems (ITS) techniques. This paper reviews results from the integration of an Intelligent Structured Trainer with the embedded Virtual Warrior Soldier prototype developed for the Army RDECOM Simulation and Training Technology Center. Army subject matter experts defined dismounted training objectives and specific requirements for integrated evaluation mechanisms. The paper discusses three areas of research results, both in terms of direct research findings and also how these findings can be applied for future work. First, the effort identified the nature of the data that an integrated structured trainer consumes in order to generate useful real-time feedback for dismounted Soldiers. This data includes not only state information direct from the simulation, but also data reflecting Soldier actions in the primary interface and secondary Command and Control interfaces. Data categories can be generalized and catalogued for future related training efforts. The second research outcome is an analysis of scenario authoring requirements, in terms of SAF 'semi-automated forces' performance, terrain database accuracy and consistency, data protocols and availability, and the authoring process itself. Third, user feedback collected from initial experiments with human Participants provide several indicators for the areas of greatest fit or friction

between the dismantled training objectives and a structured training approach.

DTIC

Computerized Simulation; Education; Training Devices; Virtual Reality

20080003122 Naval Research Lab., Bay Saint Louis, MS USA

Objectively Assessing Underwater Image Quality for the Purpose of Automated Restoration

Hou, Weilin; Wiedemann, Alan D; Oct 2007; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474285; NRL/PP/7330-07-7123; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To automatically enhance and restore images, especially those taken from underwater environments where scattering and absorption by the medium strongly influence the imaging results even within short distances, it is critical to have access to an objective measure of the quality of images obtained. This contribution presents an approach to measure the sharpness of an image based on the weighted gray-scale-angle (GSA) of detected edges. Images are first decomposed by a wavelet transform to remove random and part medium noises, to augment the chances of true edge detection. Sharpness of each edge is then determined by regression analysis to determine the slope between gray-scale values of edge pixels versus locations, which is the tangent of an angle based on gray scale. The overall sharpness of the image is the average of each measured GSAs, weighted by the ratio of the power of the first-level decomposition details, to the total power of the image. Adaptive determination of edge widths is facilitated by values associated with image noise variances. To further remove the noise contamination, edge widths less than corresponding noise variances or regression requirements are discarded. Only horizontal edge widths are used in this study. Standard test images as well as those taken from the field are compared subjectively. Initial restoration results from field-measured underwater images based on this approach also are presented and discussed.

DTIC

Image Resolution; Quality; Restoration; Underwater Photography

20080003129 Naval Research Lab., Bay Saint Louis, MS USA

Automated Underwater Image Restoration and Retrieval of Related Optical Properties

Hou, Weilin; Gray, Deric J; Weidemann, Alan D; Fournier, Georges R; Forand, J L; Oct 2007; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474300; NRL/PP/7330-07-7173; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study is aimed at establishing a framework to restore underwater imagery to the best possible level, working with both simulated and field-measured data. Using this framework, the traditional image restoration approach is extended by incorporating underwater optical properties into the system response function, specifically the point spread function (PSF) in the spatial domain and the modulation transfer function (MTF) in the frequency domain. Due to the intensity variations involved in underwater sensing, denoising is carefully carried out by wavelet decompositions. This process is necessary for exploring different effects of restoration constraints, and especially their response to the underwater environment, where the effects of scattering can be easily treated as either signal or noise. The images are then restored using measured or modeled PSFs. An objective image quality metric, tuned with environmental optical properties, is designed to gauge the effectiveness of the restoration, and serves to check the optimization approach. This metric utilizes previous wavelet decompositions to constrain the sharpness metric based on gray-scale slopes at the edge, weighted by the ratio of the power of high frequency components of the image to the total power of the image. Modeled PSFs, based on Wells' small-angle approximations, are compared to those derived from Monte Carlo simulation using measured scattering properties. Initial results are presented, including the estimation of water optical properties from the imagery-derived MTFs, and optimization outputs applying the automated restoration framework.

DTIC

Data Retrieval; Image Resolution; Optical Properties; Quality; Restoration; Underwater Photography

20080003163 Naval Postgraduate School, Monterey, CA USA

Fusion of Multiple Sensor Types in Computer Vision Systems

Mayo, Jr, Donald R; Sep 2007; 107 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474375; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research provides an analysis of several approaches to the fusion of multiple dissimilar sensors to supplement simple color vision detection and recognition. Nonvisible sensor systems can enhance computer vision systems. The study investigates the use of thermal infrared (IR) sensors in combination with color data for object detection and recognition. The authors analyze several types of high-level and low-level sensor fusion to compare error rates with raw color and raw IR error

rates in detection and recognition of vehicles in a scene. Principal components analysis is used to reduce the dimensionality of sensor input data to discard nonessential data, while preserving data important to classification. One recognition method showing promise is to exploit the strength of nonvisible information (e.g., low light, shadows, etc.) to reduce the search space for color data by replacing the V channel in the HSV color sensor data with IR. For detection, one method showing promise is the replacement or averaging of the dominant color channel with IR.

DTIC

Cameras; Color; Color Vision; Computer Vision; Detection; Infrared Imagery; Infrared Radiation; Multisensor Fusion; Target Acquisition; Thermal Mapping

20080003359 Naval Postgraduate School, Monterey, CA USA

The Abbott and Costello Effect: Who's on What, and What's Where When? A Human-Centered Method to Investigate Network Centric Warfare Systems

Reed, Derek W; Sep 2007; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474389; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Technological advancements, especially in communications systems, have led to a burgeoning interest in network centric warfare (NCW), fundamentally changing how warfare is being conducted. Network centric warfare (NCW) systems are being rushed to the field and are offered as a solution for the fog of war and as a way to reduce manpower costs. To date, there are no empirical findings that support or refute these NCW system claims. The goal of this thesis was to ascertain the utility of the Geographical Recall and Analysis of Data in the Environment (GRADE) as a method and process by which complex human-technological systems can be assessed. The GRADE builds upon the Dynamic Model of Situated Cognition (DMSC). This study essentially determines if GRADE could be used in model validation in laboratory and field settings for evaluating NCW claims. Unfortunately, that research goal was not entirely realized due to constraints and limitations in the data collection exercise. The thesis discusses the lessons learned from this research effort and makes recommendations about future exercises and how to better populate the DMSC with data. Additional recommendations for changes to the processes and procedures for data collection are provided.

DTIC

Data Acquisition; Telecommunication; Warfare; Human-Computer Interface; Communication Networks

20080005227 Naval Postgraduate School, Monterey, CA USA

Autonomous Coordination and Online Motion Modeling for Mobile Robots

Sjoberg, Eric J; Sep 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474495; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Robots are rapidly becoming more involved in everyday military operations. As robots become more capable, their tasks will increase to include such roles as exploring enemy controlled buildings and caves. The goal of this thesis is to explore methodologies that allow robots to operate more autonomously. The first goal is to develop an algorithm that allows groups of robots to construct controlled formations with only local information. Experiments investigate the ability of this algorithm to handle obstacles, dynamic conditions, and varying number of robots. The second goal of this work is to demonstrate a method by which a robot can automatically determine how it is moving. Experiments demonstrate the ability of the algorithm to learn new models given models from other surfaces and robots. This work facilitates further research into creating complex formations using only local information and in fully automating current Simultaneous Localization And Mapping (SLAM) applications.

DTIC

Autonomous Navigation; Autonomy; Coordination; Robots

20080005353 Signal Innovations Group, Inc., Durham, NC USA

Multi-Sensor Information Integration and Automatic Understanding

Welborn, Matthew; Venters, Samantha; Nov 27, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-C-0294

Report No.(s): AD-A474670; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this program is to address the development of algorithms for adaptive processing of multi-sensor data, employing feedback to optimize the linkage between observed data and sensor control. The envisioned multi-modal adaptive system is applicable for intelligence, surveillance, and reconnaissance (ISR) in general environments, addressing base and port security, as well as urban and suburban sensing during wartime and peacekeeping operations. Of significant importance for

current and anticipated DoD activities, the ISR system is designed to detect asymmetric threats, with the goal of recognizing unusual behavior or activities. Technologies and systems developed under this effort will be designed for semi-automated scene awareness, with the objective of recognizing behavior that appears atypical (e.g. atypical object motion, and dynamic characteristics of people and vehicles). Leveraging their previously developed technology, SIG is developing second-generation methods to adaptively learn the statistics of dynamic object behavior in video, while focusing on defining system requirements for sensor deployment by using field data (vs. highly controlled indoor data). Over the course of the past 2 months, significant progress has been made towards adding the final features necessary for the video tracking system. The code has successfully transitioned into its final format in C for efficient implementation, allowing one to perform significant optimizations and achieve very efficient running times, on the order of 35 frames per second. The authors also have added important capabilities for object tracking across multiple cameras, object classification (allowing behavior analysis to be conditioned on the type of object observed), and virtual pan/tilt/zoom capabilities.

DTIC

Cameras; Data Processing; Image Processing; Multisensor Applications; Multisensor Fusion

20080005368 Duke Univ., Durham, NC USA

Development and Characterization of Novel Volumetric Acquisition Orbits with an Application Specific Emission Tomograph for Improved Breast Cancer Detection

Perez, Kristy; Brzymialkiewicz, Caryl N; Aug 2007; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0558

Report No.(s): AD-A474697; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of this work was to develop, implement, and evaluate novel three-dimensional acquisition orbits for a dedicated emission mammotomography system. The system can revolve around a pendant, uncompressed breast with fully three dimensional orbital trajectories, which allow for chest wall and axillary imaging. Further optimization and characterization of the system's flexible trajectories and resulting reconstructed images continues. Upon the recommendations from this and prior work, one patient study has been completed.

DTIC

Breast; Cancer; Computer Aided Tomography; Detection; Mammary Glands; Tomography

20080005386 Boston Univ., Boston, MA USA

A MURI Center for Intelligent Biomimetic Image Processing and Classification

Grossberg, Stephen; Nov 2007; 36 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0624

Report No.(s): AD-A474727; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Senior faculty coordinate small teams of faculty/student researchers on projects to develop the unified SMartVISION system. Biological modeling projects --discover fundamental organizational principles and mechanisms that enable the brain to adapt in real-time to unexpected environmental challenges, translate them into mathematical models, and use the models to quantitatively simulate large brain and behavioral data bases about vision, object recognition, and tracking. These models have introduced two revolutionary new paradigms into intelligent computing, Laminar Computing and Complementary Computing, whose impact will be increasingly felt during the next several decades. A linkage between brain and behavior is necessary for technology transfer, because brain mechanisms say how it works, and behavioral functions say what it is for. Moreover, models that can adapt autonomously in real time to a changing world are of great importance in solving outstanding technological problems. That is why, on the technological side, brain/behavior models from BU have been used and further developed by a number of companies, hospitals, and national labs to process data from artificial sensors such as synthetic aperture radar, laser radar, multispectral infrared, night vision, nuclear magnetic resonance, and high altitude photography for large-scale applications to DoD applications and technology.

DTIC

Biomimetics; Circuits; Classifications; Image Processing

20080005695 Army Research Lab., Aberdeen Proving Ground, MD USA

Implementation of Automation for Control of Robotic Systems

Cosenzo, Keryl A; Parasuraman, Raja; Novak, Anthony; Barnes, Michael; May 2006; 42 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474882; ARL-TR-3808; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Future Combat Systems (FCS) represent an integrated materiel approach to transform the future U.S. Army into a more

lethal, deployable, and survivable force. Technology alone will not ensure efficacy. Soldiers (and specifically their performance in this environment) will determine the success or failure of the fielded systems. In particular, robotic technology will be a vital component of future combat because it will extend manned capabilities, acting as force multipliers, and most importantly, it will save lives. The role of the human operator in the human-robot environment is not well understood; however, most contemplated systems will require active human control or supervision with the possibility of intervention. In the most extreme case, Soldiers will operate multiple systems while moving and while undergoing enemy fire. In all cases, workload and stress will be variable and unpredictable, changing rapidly as a function of the military environment. Automation technologies have been successfully applied to aid human operators in various environments, including aviation and military command and control. This report addresses strategies to minimize the demands on Soldiers in the robotic environment through the use of adaptive and adaptable automation. Adaptable interfaces allow the Soldier to define conditions for automation decisions during mission planning while adaptive interfaces automate tasks as a function of some environmental or behavioral indicator (Parasuraman, Sheridan, & Wickens, 2000). Although multiple robot control and the application of adaptive and adaptable automation have been investigated in some contexts, they have not been investigated as an aid to multiple robot control. We are examining the use of adaptive or adaptable automation to assist an operator who will control multiple robotic aerial and ground systems from a single interface in a vehicular environment. In this report, we provide an overview of the current state of the research.

DTIC

Automatic Control; Combat; Robotics

20080005826 Naval Postgraduate School, Monterey, CA USA

Guidance Laws, Obstacle Avoidance, Artificial Potential Functions (Preprint)

Healey, Anthony J; Mar 2006; 36 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474852; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the context of autonomy for underwater vehicles, we assume that a usual suite of feedback controllers are present in the form of autopilot functions that provide for the regulation of vehicle speed, heading, and depth or altitude. In this chapter, we consider the topic of Guidance Laws, Obstacle Avoidance and the use of Artificial Potential Functions (APFs). This topic deals with the computations required to plan and develop paths and commands, which are used by these auto-pilots. Simple guidance laws such as proportional guidance have been used for many years in missiles to provide interception with targets. Lateral accelerations are commanded proportional to the rate of change of line of sight. So long as the chaser vehicle has a speed advantage over the non-maneuvering target, simply reducing the angle of line.

DTIC

Automatic Pilots; Laws; Obstacle Avoidance; Underwater Vehicles

20080005844 Army Research Inst. for the Behavioral and Social Sciences, Orlando, FL USA

Training Wayfinding: Natural Movement in Mixed Reality

Savage, Ruthann; Oct 2007; 70 pp.; In English

Contract(s)/Grant(s): Proj-A790

Report No.(s): AD-A474915; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes an experiment that investigated a prototype mixed reality (MR) system, utilizing the Battlefield Augmented Reality System (BARS), for training wayfinding. BARS is a mobile augmented reality system that uses a head mounted display (HMD) and a wireless system that tracks the users' head position and orientation. In this application a graphic representation of an office space was used as a virtual environment (VE), through which users walked using natural movement. Sixty participants in three rehearsal conditions - drawing the route on a map, actual physical space, and MR - were trained to traverse a path through a complex area as quickly and accurately as possible. Transfer of training measures included route knowledge (time to complete the route and the number of errors committed) and survey knowledge (the ability to orient oneself to the environment and identify the location of the beginning and end of the route). MR participants performed as well as those who rehearsed by drawing the route on a map, in both route and survey knowledge, but not as well as those who rehearsed in the actual space, without reporting symptoms of simulator sickness, common to work in VE. The addition of natural movement to a VE may enhance training through proprioceptive feedback.

DTIC

Education; Navigation; Virtual Reality

20080005850 Naval Postgraduate School, Monterey, CA USA

AUV Experiments in Obstacle Avoidance

Horner, D P; Healey, A J; Kragelund, S P; Sep 2005; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474887; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reactive Obstacle Avoidance 'OA' is an important step in attaining greater autonomy in Autonomous Underwater Vehicles 'AUV'. For AUVs that conduct underwater surveys, avoidance of uncharted obstacles can improve vehicle survivability. This paper discusses initial experiments at the Center for AUV Research in obstacle detection and avoidance using the Naval Postgraduate School ARIES AUV with the Blueview Blazed Array forward looking sonar. It includes a discussion on evaluating OA optimality, autopilot control design and sonar image processing. It concludes with a description of successful results from a recent demonstration.

DTIC

Avoidance; Obstacle Avoidance; Sonar; Underwater Vehicles

20080006122 Sensimetrics Corp., Somerville, MA USA

Application of Cortical Processing Theory to Acoustical Analysis

Ghitza, Oded; Jul 27, 2007; 30 pp.; In English

Contract(s)/Grant(s): FA95505-05-C-0032

Report No.(s): AD-A475025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475025>

We developed a computational model of diphone perception based on salient properties of peripheral and central auditory processing. The model comprises an efferent-inspired closed-loop model of the auditory periphery (PAM) connected to a template-matching circuit (TMC). Robustness against background noise is provided principally by the signal processing performed by the PAM, while insensitivity to time-scale variations is provided by properties of the TMC. The PAM parameters were determined in isolation from the TMC. This was achieved by analyzing confusion patterns generated in a paradigm with a minimal cognitive load (the binary Diagnostic Rhyme Test [DRT], with synthetic speech stimuli to restrict phonemic variation). Originally, we intended to test the model by quantifying its ability to predict human performance in perceiving naturally spoken speech in the presence of noise, in two separate tasks: (1) diphone discrimination of minimal word-pairs (Voiers' DRT), and (2) phone identification of schwa-CVC tokens. Eventually, the model was evaluated using synthetic speech material.

DTIC

Auditory Perception; Error Analysis

20080006285 Navy Technology Center for Safety and Survivability, Washington, DC, DC USA

Comparison of Fire and Smoke Simulator (FSSIM) Predictions with Hydraulic Fluid Spray Fire Test Data

Hoover, John B; Williams, Frederick W; Dec 10, 2007; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475138; NRL/MR/6180--07-9095; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Results from large-scale hydraulic fluid spray fire tests have been compared with simulations of those tests using the Fire and Smoke Simulator (FSSIM) model. Using a model calibration data set, the sensitivity of FSSIM to several key inputs was evaluated; for the critical heat release rate (HRR) parameter, an adjustment factor was estimated to correct for unburned fuel. The resulting input parameters were then applied to similar data sets and the predictions compared with test data. In most cases, very good agreement was obtained. Some issues related to the use of the FSSIM graphical interface, including directions for future development, were discussed.

DTIC

Fires; Hydraulic Fluids; Ships; Simulation; Simulators; Smoke; Sprayers

NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20080002928 Defence Science and Technology Organisation, Edgecliff, Australia
Comparison of Two Alternative Movement Algorithms for Agent Based Distillations

Grieger, Dion; Aug 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473902; DSTO-TN-0777; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473902>

This paper examines two movement algorithm options available to the user in the MANA (Map Aware Non-Uniform Automata) agent based distillation. The default Stephen algorithm is compared with nine variations of the alternative Gill algorithm and tested over six different scenarios.

DTIC

Algorithms; Distillation; Operations Research

20080002935 Yale Univ., New Haven, CT USA
Compressed Scattering Matrices and Fast Direct Solvers

Rokhlin, Vladimir; Oct 18, 2007; 9 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0239

Report No.(s): AD-A473925; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473925>

New direct and analytically preconditioned frequency and time domain integral equation solvers have been developed. First mechanisms for compressing scattering matrices in static and relatively low-frequency environments will be pursued and used in the construction of direct frequency domain integral equation solvers applicable to objects roughly 40 wavelengths in size. Second hierarchical and Calderon preconditioned time-domain integral equation solvers were developed. These solvers remain rapidly convergent and stable even when applied to very low-frequency problems and/or very densely meshed structures. Third, the methods developed gave rise to new techniques for designing numerical quadratures and for computing singular value decompositions.

DTIC

Integral Equations; Inverse Scattering; Scattering

20080002947 Naval Postgraduate School, Monterey, CA USA
Autonomous Non-Linear Classification of LPI Radar Signal Modulations

Gulum, Taylan O; Sep 2007; 217 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473944; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473944>

In this thesis, an autonomous feature extraction algorithm for classification of Low Probability of Intercept (LPI) radar modulations is investigated. A software engineering architecture that allows a full investigation of various preprocessing algorithms and classification techniques is applied to a database of important LPI radar waveform modulations including Frequency Modulation Continuous Waveform (FMCW), Phase Shift Keying (PSK), Frequency Shift Keying (FSK) and combined PSK and FSK. The architecture uses time-frequency detection techniques to identify the parameters of the modulation. These include the Wigner-Ville distribution, the Choi-Williams distribution and quadrature mirror filtering. Autonomous time-frequency image cropping algorithm is followed by a feature extraction algorithm based on principal components analysis. Classification networks include the multilayer perceptron, the radial basis function and the probabilistic neural networks. Lastly, using image processing techniques on images obtained by the Wigner-Ville distribution and the Choi-Williams distribution, two autonomous extraction algorithms are investigated to derive the significant modulation parameters of polyphase coded LPI radar waveform modulations.

DTIC

Algorithms; Autonomy; Classifications; Computer Programming; Nonlinearity; Software Engineering

20080002987 Naval Postgraduate School, Monterey, CA USA

Optimization of a Marine Corps Artillery Battalion Supply Distribution Network

Heisinger, Ryan R; Sep 2007; 67 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474029>

Currently, the Marine Corps does not have a process or system to distribute supplies in support of combat operations in an optimal manner. We consider the problem of re-supplying a forward-deployed USA Marine Corps artillery battalion. Specifically, we model a supply distribution network of roads between the battalion supply area, the firing batteries, and the headquarters battery. Our objective is to develop a decision support tool to help a logistics officer build efficient supply convoys that deliver all demanded supplies to the requesting units in the shortest convoy route. The supply distribution network consists of a set of locations connected by roads of known length. A small number of these nodes are logistics nodes that either supply or demand the commodities in our model, while the majority of the nodes are transshipment nodes. We use Dijkstra's algorithm to calculate the associated shortest travel distance between each pair of logistics nodes and then enumerate all possible tours through the logistics nodes. From this list of potential convoy routes, we determine the best combination of vehicles and supplies to assign to each in a manner that satisfies operational constraints and meets the mission objectives. The decision the logistics officer has to make is to determine the convoy(s) that will deliver the demanded supplies in the shortest convoy route with the number of available vehicles to support the convoy. This model provides insight to the logistics officer about how to build convoys to distribute supplies optimally within the network.

DTIC

Artillery; Logistics; Networks; Optimization; Organizations; Supplying

20080002990 Purdue Univ., West Lafayette, IN USA

Bias/Variance Analysis for Relational Domains

Neville, Jennifer; Jensen, David; Aug 15, 2007; 13 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): HR0011-04-1-0013; IIS-0326249

Report No.(s): AD-A474037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474037>

Bias/variance analysis is a useful tool for investigating the performance of machine learning algorithms. Conventional analysis decomposes loss into errors due to aspects of the learning process, but in relational domains, the inference process introduces an additional source of error. Collective inference techniques introduce additional error both through the use of approximate inference algorithms and through variation in the availability of test set information. To date, the impact of inference error on model performance has not been investigated. In this paper, we propose a new bias/variance framework that decomposes loss into errors due to both the learning and inference process. We evaluate performance of three relational models and show that (1) inference can be a significant source of error, and (2) the models exhibit different types of errors as data characteristics are varied.

DTIC

Bias; Domains; Inference

20080003003 Naval Postgraduate School, Monterey, CA USA

High-Speed Numeric Function Generator Using Piecewise Quadratic Approximations

Macaria, Njuguna; Sep 2007; 216 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474061; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474061>

The CORDIC algorithm is an accurate way to compute the value of a function like $\sin(x)$, for a given value of x . However, it is iterative and slow. In this thesis, we show that a wide class of arithmetic functions can be realized on the SRC-6, a reconfigurable computer, using polynomial approximations. The function is realized by partitioning its domain into segments and then approximating the function in each segment by a quadratic polynomial. This is not an iterative approach, and so it is faster than the CORDIC algorithm. Two approximation methods are implemented. In one method, non-uniform segments are used. Here, larger segments can be used where the function is close to quadratic, while highly non-quadratic regions require smaller segments. This approach minimizes the number of segments. In the other method, uniform segments are used. Although more segments are needed than in the non-uniform method, the circuit is simpler. We show that accuracies of up to 33 bits are possible. A pipelined circuit was built on the SRC-6 in two's complement and floating point. We also show an

efficient algorithm for segmenting the function, which is faster than previous methods.

DTIC

Function Generators; High Speed

20080003021 Brunel Univ., Uxbridge, UK

Development of Multi-Adaptive Simulation Technologies for Nonlinear Solid Polymer Viscoelasticity

Whiteman, J R; Warby, M K; Shaw, Simon; Oct 31, 2007; 61 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W911NF-04-1-0185

Report No.(s): AD-A474092; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474092>

This project has been concerned with the reliable computation of engineering Quantities of Interest (QoI), and the application of these mathematical methods to problems of interest to the US Army (informed by our long-standing contact with Dr A R Johnson, ARL, VTD, LaRC). In the project we have applied state-of-the-art mathematical theory to a practical large deformation engineering problem in membrane inflation. In doing this we have applied modern methods of a posteriori error estimation in order to address the error in the engineering QoI that arise from modelling simplifications and also from finite element approximation. Our results show that this technique works in that it can be used to adaptively optimize the finite element mesh, as well as to !give an indication of the physical error contained in the modelling assumptions. The eventual benefit of research of this nature and the downstream uptake of the techniques and methodology into commercial engineering software cannot be overstated. By isolating and estimating the two principal sources of error in physical simulations (modelling and discretization) the software will allow the practitioner to assign a degree of confidence in the results that has never before been possible.

DTIC

Nonlinearity; Polymers; Simulation; Viscoelasticity

20080003027 Turkish General Staff Headquarters, Ankara, Turkey

Formatted Message Exchange in a Multinational Environment

Ucuncu, Murat; Demirezen, Jr , M U; Dec 1, 2006; 27 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474117; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474117>

No abstract available

Interoperability; Messages; Multisensor Fusion

20080003086 Carnegie-Mellon Univ., Pittsburgh, PA USA

Minimization and Reliability Analyses of Attack Graphs

Jha, Somesh; Sheyner, Oleg; Wing, Jeannette M; Feb 2002; 31 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0485

Report No.(s): AD-A474191; CMU-CS-02-109; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An attack graph is a succinct representation of all paths through a system that end in a state where an intruder has successfully achieved his goal. Today Red Teams determine the vulnerability of networked systems by drawing gigantic attack graphs by hand. Constructing attack graphs by hand is tedious, error-prone, and impractical for large systems. By viewing an attack as a violation of a safety property, we can use model checking to produce attack graphs automatically: a successful path from the intruder's viewpoint is a counterexample produced by the model checker. In this paper we present an algorithm for generating attack graphs using model checking. Security analysts use attack graphs for detection, defense, and forensics. In this paper we present a minimization technique that allows analysts to decide which minimal set of security measures would guarantee the safety of the system. We provide a formal characterization of this problem: we prove that it is polynomially equivalent to the minimum hitting set problem and we present a greedy algorithm with provable bounds. We also present a reliability technique that allows analysts to perform a simple cost-benefit analysis depending on the likelihoods of attacks. By interpreting attack graphs as Markov Decision Processes we can use a standard MDP value iteration algorithm to compute the probabilities of intruder success for each attack the graph. We illustrate our work in the context of a small example that includes models of a firewall and an intrusion detection system.

DTIC

Algorithms; Computer Networks; Cost Analysis; Cost Effectiveness; Detection; Markov Processes; Optimization; Reliability Analysis; Warning Systems

20080003106 Maryland Univ., College Park, MD USA

Integrated Risk-Sensitive, Simulation-Based and Graphical Methodologies for Estimation and Control

Marcus, Steven I; Oct 18, 2007; 28 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0210

Report No.(s): AD-A474241; AFRL-SR-AR-TR-07-0508; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In support of the second task, the researchers made progress incorporating simulation-based optimization and population-based methods into optimization problems. They made significant progress on new simulation-based global optimization methods, as well as on evolutionary approaches to solving Markov Decision Processes (MDPs), new sampling methods for MDPs, simulation based methods for MDPs, new approaches to the allocation of simulation replications for optimization, and applications of these algorithms.

DTIC

Markov Processes; Risk; Sensitivity; Simulation

20080003154 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Finite Element Analysis of Lamb Waves Acting within a Thin Aluminum Plate

Han, SeJin; Sep 2007; 162 pp.; In English

Report No.(s): AD-A474354; AFIT/GAE/ENY/07-S02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Structural health monitoring (SHM) is an emerging technology that can be used to identify, locate and quantify structural damages before failure. Among SHM techniques, Lamb waves have become widely used since they can cover large areas from one single location. Due to the development of various structural simulation programs, there is increasing interest in whether SHM data obtained from the simulation can be verified by experimentation. The objective of this thesis is to determine Lamb wave responses using SHM models in ABAQUS CAE(a Finite Element Analysis(FEA) program). These results are then compared to experimental results and theoretical predictions under isothermal and thermal gradient conditions in order to assess the sensitivity of piezo-generated Lamb wave propagation. Simulations of isothermal tests are conducted over a temperature range of 0-190 deg F with 100kHz and 300kHz excitation signal frequencies. The changes in temperature-dependent material properties are correlated to measurable differences in the response signal's waveform and propagation speed. An analysis of the simulated signal response data demonstrated that elevated temperatures delay wave propagation, although the delays are minimal at the temperatures tested in this study.

DTIC

Aluminum; Finite Element Method; Lamb Waves; Metal Plates; Thin Plates; Wave Propagation

20080003174 Naval Postgraduate School, Monterey, CA USA

Lagrangian Observations of Rip Currents

Morrison, Jonathan D; Sep 2007; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474395; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A comprehensive field rip-current experiment (RCEX) was conducted from 14 April to 18 May 2007 in Sand City, California, on Monterey Bay. Lagrangian observations were made with inexpensive (\$150), handheld, Differential Global Positioning Systems (DGPS) mounted on surf zone drifters. The inexpensive DGPS requires post-processing to achieve O(0.4m) position accuracy and O(0.01m/s) velocity accuracy. Thirty drifters were constructed and deployed in well-developed, rip-currents to map the circulation patterns for the first time in the field at a high spatial resolution. Drifter observations obtained during three hour periods on seven different days under varying wave and tidal conditions describe eddies with a rotational period of 4.7min, confined to the surf-zone and coupled to the rip morphology. On average, three drifters per hour exited the surf-zone. Dependent upon wave conditions, one or two eddies existed between 90m-spaced rip-channels, creating a seaward flow in the channels and shoreward flow over the shoals. Cross-shore volumetric flow rates for an alongshore transect through the eddy centers balance to a difference of less than 10% of the gross flow discharge. Velocity measurements obtained from drifter data are evaluated with velocities obtained from stationary, in-situ instruments.

DTIC

Eddy Currents; Global Positioning System; Lagrangian Function; Shallow Water

20080003183 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Time Dependent Discrete Ordinates Neutron Transport Using Distribution Iteration in XYZ Geometry

Dishaw, James R; Sep 2007; 146 pp.; In English

Report No.(s): AD-A474406; AFIT/DS/ENP/07-S01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The DI algorithm is an alternative to source iteration that, in our testing, does not require an accelerator. I developed a formal verification plan and executed it to verify the results produced by my code that implemented DI with the above features. A new, matrix albedo, boundary condition treatment was developed and implemented so that infinite-medium benchmarks could be included in the verification test suite. The DI algorithm was modified for parallel efficiency and the prior instability of the refinement sweep was corrected. The testing revealed that DI performed as well or faster than source iteration with DSA and that DI continued to work where DSA failed. Performance did degrade when the diamond-difference (without fixup) spatial quadrature was used. Because diamond-difference is a non-positive spatial quadrature, it can produce nonphysical negative fluxes, particularly in higher dimensions. I developed a new fixup scheme to accommodate the negative fluxes, but it did not improve performance in XYZ geometry when the scattering ratio was near unity.

DTIC

Geometry; Iteration; Neutrons; Time Dependence; Transport Theory

20080003335 Air Force Research Lab., Edwards AFB, CA USA

Particle Motion Algorithm for Arbitrary Gyro-Frequencies

Cambier, Jean-Luc; Batishchev, Oleg; Sep 2007; 18 pp.; In English

Report No.(s): AD-A474425; AFRL-RZ-ED-TP-2007-431; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The transport of particles in a Particle-In-Cell (PIC) method is traditionally handled by a staggered algorithm, second-order accurate in time, originally developed by Boris [1-2]. The scheme is very efficient and although it is stable for time steps large compared to the cyclotron period ('gyro-period'), it ceases to be accurate in that case. In cases of strong applied magnetic field, this can impose an impractical time-step restriction. An alternative approach is to average over the orbital motion and consider only that of the guiding-center; this has led to so-called gyrokinetic simulations [3]. However, that approach can also lead to some inaccuracies, due to the loss of information regarding the phase of the orbital motion. Furthermore, it may also be desirable to have an algorithm that is not staggered in time, in order to guarantee exact conservation of total energy at all times. In this paper, we present an algorithm that solves the non-relativistic equation of motion exactly, and can yield exact conservation of energy for large time steps (compared to gyroperiod). The algorithm accuracy is demonstrated and compared with the Boris scheme. These preliminary results are valid for the homogenous case only, and extension to spatially-varying fields should be considered next.

DTIC

Algorithms; Charged Particles; Electric Fields; Gyroscopes; Magnetic Fields; Particle Motion

20080005605 National Univ. of Singapore, Singapore

Development of AIM-Based Fast Solver for Efficient Design and Synthesis of Negative Index Materials

Li, Joshua L; Dec 6, 2007; 65 pp.; In English

Contract(s)/Grant(s): FA4868-06-01-0054

Report No.(s): AD-A474738; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474738>

This report presents a fast hybrid volume-surface integral equation approach for the computation of electromagnetic scattering from composite left-handed materials (LHM) such as split-ring resonators (SRR) with wires. The volume electric field integral equation (EFIE) is applied to the dielectric region of this LHM, and the surface electric field integral equation is applied on the conducting surface. The method of moments (MoM) is used to discretize the integral equation into a matrix solution and adaptive integral method (AIM) is employed to reduce the memory requirement and CPU time for the matrix solution. This approach is applied to antenna design to improve the performance of an ordinary microstrip-feed patch antenna. The antenna's bandwidth is greatly broadened while the VSWR remains very low and radiation efficiency is high. The future interesting and practical research is also proposed in the report.

DTIC

Electromagnetic Scattering; Integral Equations

20080006098 Florida International Univ., Miami, FL USA

IPDO-2007 - Inverse Problems, Design and Optimization Symposium

Dulikravich, George S; Dec 1, 2007; 29 pp.; In English

Contract(s)/Grant(s): FA9550-07-1-0290

Report No.(s): AD-A474996; FIU-212600581-REP-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474996>

IPDO-2007 Symposium's main objectives were to bring the three communities of researchers (inverse problems experts, design theory experts, and optimization experts) together and provide a common forum for presenting different applications, problems, and solution strategy concepts. These three areas of research covered by the IPDO Symposium have a number of things in common. For example, many methodologies for solving inverse problems employ optimization algorithms. However, there are no optimization algorithms that employ methods of inverse design that could substantially reduce the number of time-consuming analysis required by the typical evolutionary optimization algorithms. Similarly, design theory is not well known in the optimization community where formulation of the appropriate multiple objectives and system-of-systems design formulations are often performed using intuition and personal experience. The IPDO-2007 Symposium thus offered a unique international forum that was expected to provide an excellent basis for cross-fertilization of ideas and creation of new synergistic approaches and methodologies that will combine the three fields of research so that more general, robust, accurate and computationally economical design methods are created for multi-disciplinary applications. Contributions dealing with practical applications were encouraged, such as in petrochemistry, aeronautics, bio-medicine, sensing of pollutants, materials processing, non-destructive evaluation, material property determination, etc.

DTIC

Conferences; Design Optimization

20080006147 Explosives Research and Development Establishment, Waltham Abbey, UK

Tables for the Calculation of Combustion Temperatures and Specific Impulses of Propellants

Vernon, J H; Jul 1954; 25 pp.; In English

Report No.(s): AD-A475105; ERDE-TM-4/M/54; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475105>

A number of tables and a nomograph for calculating the combustion temperature and specific impulse of propellants are presented. The tables are extensions and modification of those already given by Pike. It is claimed that their use, in conjunction with the nomograph, considerably reduces the labour of calculating specific impulse.

DTIC

Combustion Temperature; Propellants; Specific Impulse

20080006270 Cornell Univ., Ithaca, NY USA

Network Games and Approximation Algorithms

Tardos, Eva; Jan 3, 2008; 6 pp.; In English

Contract(s)/Grant(s): N00014-05-1-0166

Report No.(s): AD-A475114; 48232; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Over the three years of 10/1/2004 though 9/30/2007, the grant supported the PI Eva Tardos, and provided partial support for students Zoya Svitkina, and Thanh Nguyen, Ara Hayrapetyan, Georgios Piliouras, and student and later postdoctoral fellow Tom Wexler. Tom left Cornell for a faculty position at Denison university, Ohio; Zoya is graduated this summer and left for a postdoc at Dartmouth; and Ara graduated this May and is now working at Credit Suisse in New York.

DTIC

Algorithms; Approximation; Games; Networks; User Requirements

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20080002984 Naval Postgraduate School, Monterey, CA USA

Signal Detection and Frame Synchronization of Multiple Wireless Networking Waveforms

Howland, Keith C; Sep 2007; 191 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474026; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474026>

This thesis investigates the detection, classification, frame synchronization, and demodulation of wireless networking waveforms by a digital receiver. The approach is to develop detection thresholds for wireless networking signals based upon the probability density functions of the signal present or signal absent scenarios. A Neyman-Pearson test is applied to determine decision thresholds and the associated probabilities of detection. With a chosen threshold, MATLAB simulations are run utilizing models developed to generate and receive IEEE 802.11a, IEEE 802.16, and IEEE 802.11b signals in multipath channels characterized by Rayleigh fading. Algorithms are developed for frame synchronization for each of the three waveforms. The probability of signal detection, successful frame synchronization, and the bit error rates of the received packet header and data are calculated. The results show that, even in Rayleigh fading environments at low signal to noise levels, these three waveforms can be distinguished in a digital receiver. Further, the results show that significant signal information can be gathered on these wireless networking waveforms, even when the entire signal cannot be demodulated due to low signal to noise ratios.

DTIC

Bit Synchronization; Probability Density Functions; Signal Detection; Signal to Noise Ratios; Waveforms; Wireless Communication

20080003042 BAE Systems, UK

High-Level Fusion using Bayesian Networks: Applications in Command and Control

Bladon, P; Day, P S; Hughes, T; Stanley, P; Dec 1, 2006; 55 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474170; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474170>

No abstract available

Bayes Theorem; Command and Control

20080003100 Polytechnic Inst. of New York, Brooklyn, NY USA

Nonlinear Bistable Detectors and Arrival-Time Estimators Based on Parameter-Tuning Stochastic Resonance

Wu, Xingxing; Jiang, Zhong-Ping; Xu, Bohou; Repperger, Daniel W; Dec 2006; 12 pp.; In English

Contract(s)/Grant(s): Proj-2313

Report No.(s): AD-A474234; AFRL-HE-WP-TP-2007-0001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Parameter-tuning stochastic resonance (PSR) technique provides a new approach for signal processing. This paper will first fill the gap in the performance analysis of the nonlinear PSR-based detector by comparing it with the matched filter detector under both ideal conditions (white Gaussian noise, and perfect, synchronization) and non-ideal conditions (colored noise, de-synchronization, and low sampling rate) to identify its strengths and weaknesses.

DTIC

Detectors; Nonlinearity; Random Noise; Signal Processing; Stability; Stochastic Processes; Tuning

20080003153 Naval Postgraduate School, Monterey, CA USA

Robustness: A Better Measure of Algorithm Performance

Musselman, Roger D; Sep 2007; 75 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474353; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Algorithms are an essential part of Operations Research (OR) methodology. Therefore, the efficiency of the algorithms must be a consideration. However, traditional approaches to assessing algorithm efficiency do not always captured the real-world trade-offs involved. This thesis explored the use of a new measure of algorithm efficiency, robustness, and contrasted it with the traditional big-O analysis. Sorting algorithms were used to illustrate the trade-offs. The use of Dr.

Genichi Taguchi's robust design techniques allowed us to take into account the impact of factors which would be uncontrollable in the real world, by measuring how those factors affect the consistency of the results. These factors, which are treated separately by big-O analysis, are incorporated as an integral part of robust analysis. The hypothesis was that robustness is potentially a more useful description of algorithm performance than the more traditional big-O analyses. The results of experimentation supported this hypothesis. Where big-O analysis only considers the average performance, robustness integrates the average performance and the consistency of performance. Most importantly, the robust analysis we performed yielded results that are consistent with actual usage practitioners prefer quicksort over heap sort, despite the fact that under big-O analysis heap sort dominates quicksort.

DTIC

Algorithms; Measurement; Operations Research

20080005692 Yale Univ., New Haven, CT USA

Probabilistic Analysis of Onion Routing in a Black-box Model

Feigenbaum, Joan; Johnson, Aaron; Syverson, Paul; Jan 2007; 11 pp.; In English

Contract(s)/Grant(s): W911NF-06-1-0316; W911NF-05-1-0417

Report No.(s): AD-A474872; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We perform a probabilistic analysis of onion routing. The analysis is presented in a black-box model of anonymous communication that abstracts the essential properties of onion routing in the presence of an active adversary that controls a portion of the network and knows all a priori distributions on user choices of destination. Our results quantify how much the adversary can gain in identifying users by exploiting knowledge of their probabilistic behavior. In particular, we show that a user u 's anonymity is worst either when the other users always choose the destination u is least likely to visit or when the other users always choose the destination u chooses. This worst-case anonymity with an adversary that controls a fraction b of the routers is comparable to the best-case anonymity against an adversary that controls a fraction square root of b .

DTIC

Algorithms; Electronic Equipment; Probability Theory; Protocol (Computers)

20080006110 Signal Innovations Group, Inc., Durham, NC USA

Classifier Design and Mine Identification using Multi-aspect Low Frequency Broadband Target Signatures

Rabenold, Patrick; Dasgupta, Nilanjan; Carin, Lawrence; Dec 18, 2007; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-06-C-0026

Report No.(s): AD-A475010; TR-2007/002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475010>

This report summarizes progress achieved in the current funding period by Signal Innovations Group (SIG) in supporting the Naval Research Laboratory (NRL) on the development and application of mine identification algorithms using a Low Frequency Broadband (LFBB) sonar system. This report describes a complete classification algorithm designed for identification of underwater targets using a multi-aspect correlation-based similarity metric. Of several kernel-based methods for sparse classification previously developed, the kernel matching pursuits (KMP) algorithm is shown to perform well in NRL sea tests. Additionally, a computationally efficient implementation of the relevance vector machine (RVM) has been developed that addresses several disadvantages of the KMP algorithm. Future work includes the transition of the new RVM implementation and the development of additional signal features to improve the classifier performance on challenging targets.

DTIC

Algorithms; Broadband; Classifications; Classifiers; Kernel Functions; Low Frequencies; Signatures; Sonar; Targets

20080006319 Michigan Univ., Ann Arbor, MI USA

Next-Generation Modeling, Analysis, and Testing of the Vibration of Mistuned Bladed Disks

Castanier, Matthew P; Ceccio, Steven L; Epureanu, Bogdan I; Pierre, Christophe; Dec 21, 2007; 27 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0099

Report No.(s): AD-A475211; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Turbomachinery rotors, or bladed disks, are known to suffer from severe vibration problems due to small, random deviations (mistuning) of the blade properties. Mistuning can lead to dramatic increases in the maximum blade stress and cause high cycle fatigue (HCF), which is a major cost, readiness, and safety concern for the U.S. Air Force. The primary objective of this research was to provide significantly improved understanding, modeling, and prediction of the vibration

response of mis-tuned bladed disk systems by including the effects of important phenomena that had been largely neglected in previous mistuning models. The models developed in this research program were used to investigate the interaction of blade mistuning with aerodynamic coupling, stage-to-stage connections for multistage rotors, blade damage, and nonlinearities. In addition, key mistuning phenomena were examined through vibration testing of blisks (single-piece bladed disks). New methods were developed for identifying blade mistuning parameters from test data and for running experimental Monte Carlo assessments of the effects of mistuning on the system forced response.

DTIC

Evaluation; Monte Carlo Method; Rotors; Tuning; Turbomachinery; Vibration

66

SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20080002951 Naval Postgraduate School, Monterey, CA USA

A Littoral Combat Model for Land-Sea Missile Engagements

Mahon, Casey M; Sep 2007; 104 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473951; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473951>

This thesis develops a Littoral Combat Model of interactions between Naval Ships at sea and Anti-Ship Cruise Missile Batteries on land. The Littoral Combat Model seeks to answer the question: Is a modern naval force capable of effectively operating in the dangerous littoral environment? The model is derived from a combination of Hughes Salvo Model and Lanchester's Equations. Cases are developed using either direct fire or area fire weaponry by the sea based force. Land forces deliver aimed fire with missiles, which the ships defend against. A number of embellishments are utilized to provide an in-depth analysis of the interaction. Application of the model with two representative scenarios shows (1) that attacking effectively first remains an important advantage and (2) that accurate direct fire weapons used by the sea based force against the batteries ashore will often overcome Admiral Nelson's warning that A ship's a fool to fight a fort. However, naval area fire (e.g., naval gunnery) is a key weakness in these inherently complicated littoral engagements, unless used in large volume and backed by sufficient Defensive Power in the sea based force.

DTIC

Antiship Missiles; Combat; Cruise Missiles; Missiles; Seas

20080003110 Universita del Piemonte Orientale, Alessandria, Italy

Game Theory as a Tool for Analyzing Terrorism

Fragnelli, Vito; May 1, 2006; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474249; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Game Theory; Terrorism

20080003160 Naval Postgraduate School, Monterey, CA USA

Optimizing the U.S. Marine Corps' Selective Reenlistment Bonus Program for Career Force Retention

Robbins, Jr, Kent A; Sep 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Marine Corps uses its Selective Reenlistment Bonus (SRB) Program to influence Marines to reenlist for a designated term into certain Military Occupational Specialties (MOSs) to reach planned manpower goals. The bonus amount is determined by selecting an 'SRB multiplier' for each combination of MOS and Zone (MOSZ), where 'Zone' corresponds to length of service. A higher multiplier means a larger bonus and leads to a higher percentage of Marines reenlisting. That percentage, predicted by an existing forecasting model, is assumed exact here. The 'SRB multiplier model' assigns multipliers to minimize a sum of weighted squared deviations from MOSZ targets subject to a budget constraint. This model is implemented as a generalized assignment problem, and it is solved approximately on a personal computer using Lagrangian relaxation and a secondary heuristic. (The algorithm is programmed in Visual Basic for Applications and has an Excel interface.) Data for FY04 shows 491 bonus-eligible MOSZs. With up to 11 possible multiplier values, this yields a model with 5,401 0-1 variables and 491 constraints. A solution within 0.0018% of optimality is reached in 1.4 seconds on a 1.58 GHz

personal computer. Standard integer-programming software verifies the correctness of the solution.

DTIC

Military Personnel; Models; Multipliers; Occupation

20080003782 Research Inst. for Communication, Information Processing and Ergonomics, Wachtberg-Werthhoven, Germany

Perceptual Issues of Augmented and Virtual Environments

Renkewitz, Helge; Alexander, Thomas; Jul 1, 2007; 25 pp.; In English

Report No.(s): AD-A474154; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474154>

No abstract available

Virtual Reality; Perception; Situational Awareness

20080003783 University of Central Florida, Orlando, FL USA

Dynamic Situations: The Soldier's Situation Awareness

Holmquist, John P; Goldberg, Stephen L; Jul 1, 2007; 7 pp.; In English

Report No.(s): AD-A474141; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474141>

No abstract available

Decision Making; Situational Awareness

20080005258 Academy of Sciences (Russia), Samara, Russian Federation

Complex Systems: Control and Modeling Problems

Fedosov, E A; Kuznetsov, N A; Vittikh, V A; Aug 23, 2004; 483 pp.; In English

Contract(s)/Grant(s): FA8655-03-1-5088

Report No.(s): AD-A474562; CSP 03-5088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Final Proceedings for Complex Systems: Control and Modeling Problems, 14 June 2004 - 19 June 2004 This is a computer science conference broadly covering topics related to modeling and control of complex systems and 'systems of systems'. Specific topics to be presented include: Open systems: Control and Modeling; Complex Systems: Information Interaction Models; Information Assurance in Complex Systems; System Analysis and Control Theory; Ontology analysis and synthesis; Multi-Agent Systems; Complex Engineering Systems and Enterprises management; Emergency Control; Control and Measurement in Complex Technical Systems; New Information Technologies.

DTIC

Complex Systems; Control Theory; Systems Analysis

20080005362 Army War Coll., Carlisle Barracks, PA USA

Force and Restraint in Strategic Deterrence: A Game-Theorist's Perspective

Myerson, Roger B; Nov 2007; 32 pp.; In English

Report No.(s): AD-A474684; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This monograph is a short nontechnical introduction to the use of game theory in the study of international relations. The focus is on the problem of deterrence against potential adversaries and aggressors. The author, Professor Roger Myerson, uses game models to provide a simple context where we can see more clearly the essential logic of strategic deterrence. We should look to such theoretical analysis for basic insights that may have practical importance in policymaking. The main conclusion is that a great power's use of its military forces may be rendered ineffective or even counterproductive when there are no clear internationally recognizable limits on this use of force. Professor Myerson derives this conclusion from the basic observation that our ability to influence potential rivals depends on a balanced mix of threats and promises. Potential adversaries should believe that aggression will be punished, but such threats will be useless unless they also believe our promises that good behavior will be better rewarded. A reputation for resolve makes threats credible, but a great power also needs a reputation for restraint, to make the promises credible as well. Thus, international restraints on a nation's use of military force may actually increase the effective influence of its military strength. So this monograph may be read as a contribution to our understanding of the vital relationship between diplomacy and military preparedness in defense of national security.

DTIC

Constraints; Game Theory; International Relations

20080005825 SENTAR, Inc., Huntsville, AL USA

An Extensible Architecture for Multi-Game Fusion

Flagg, Leigh; McClure, Melody; Gamble, Rose; Tiller, John; Oct 2007; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0210; Proj-558B

Report No.(s): AD-A474840; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of the Multi-Game Fusion (MGFusion) platform is to design and prototype an extensible, reusable, and verifiable wargaming environment, which provides an advanced command and control (C2) simulation and experimentation platform. This effort was meant to provide a reasonable foundation to test C2 functions and strategies through the use of commercial-grade wargames, which strive to embody humanistic actions and responses.

DTIC

Game Theory; Software Development Tools

20080006113 Baker (Wilfred) Engineering, Inc., San Antonio, TX USA

EWall - Electronic Card Wall: Computational Support for Decision-Making in Collaborative Environments

Keel, Paul; Winston, Patrick H; Porter, William L; Dec 17, 2007; 26 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-04-1-0569

Report No.(s): AD-A475014; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475014>

Our work focused on conceiving and prototyping technologies for supporting individual and collaborative sense-making activities in distributed and decentralized work environments. We developed an experimental computational environment referred to as the EWall system. The EWall system is designed to be used for users to conduct, for researchers to investigate, and for computational systems to support individual and collaborative sense-making activities. The EWall system engages users in the visual organization of information through the spatial arrangement and modification of graphical objects. Computational agents infer from spatial information arrangements and the collaborative use of information as a basis for directing the flow of information among collaborating users and computational systems. The goal of the agents is to direct the distribution of information in ways that bring together people with complimentary backgrounds, expertise, interests and objectives and that improves team shared understanding. Individual agents represent unique cognitive and collaborative concepts, combine their analyses, and autonomously adapt to particular users, tasks and circumstances. The primary contribution of this work lies in the design of concepts and mechanics that enable a noninterruptive interchange of contextual discoveries between humans and computational systems.

DTIC

Cards; Decision Making; Information Management; Information Transfer

20080006286 Naval Research Lab., Washington, DC USA

FY06 NRL DoD High Performance Computing Modernization Program Annual Reports

Shingler, Portia A; Howell, Beth A; Oct 31, 2007; 124 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475139; NRL/PU/5590--07-503; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This book is a compilation of reports on all the work accomplished by NRL scientists and engineers and their collaborators using the DoD High Performance Computing Modernization Program's (HPCMP) resources for fiscal year 2006. The reports encompass work performed by researchers at all three NRL sites: Washington, DC; Stennis Space Center, Mississippi; and Monterey, California. These reports are categorized according to the primary Computational Technology Area (CTA) as specified by the HPCMP, and include resources at the Major Shared Resources Centers as well as the Distributed Centers. This volume includes three indexes for ease of reference. These are an author index, a site index, and an NRL hierarchical index of reports from the Branches and Divisions in the Laboratory.

DTIC

Architecture (Computers); Computerized Simulation

20080006343 Defence Research and Development Canada, Valcartier, Quebec Canada

Complexity and Chaos - State-of-the-Art; Glossary

Couture, Mario; Sep 2007; 106 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475275; DRDC-V-TN-2006-452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A number of 335 key words related to Complexity Theory, chaos and complex systems are defined in this document. For

a number of these key words, many definitions originating from different authors are proposed. The aim is to provide the reader some of the perspectives that can be found in the scientific literature regarding the interpretation of concepts in this domain.

DTIC

Chaos; Complex Systems; Dictionaries

67

THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20080003001 North Carolina State Univ., Raleigh, NC USA

Theoretical and Numerical Analysis for Non-Linear Interface Problems

Li, Zhilin; Ito, Kazufumi; Apr 19, 2007; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0394

Report No.(s): AD-A474058; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474058>

This proposal concerns modeling, analysis, and computational simulations of some non-linear interface problems and applications, that, we believe, are of interests to DOD/ARO missions especially in the fields of computational geometry, computational fluid mechanics, non-linear dynamics, imaging processing, and inverse scattering. Most of our previous work has been focused on linear interface problems with discontinuities. We have been focusing on non-linear interface problems and applications that are of interests of DoD/ARO during the course of the project, particularly for nonlinear interface problems in MR fluids and weighted surface problems. We have successfully developed the immersed interface method for several non-linear interface problems including Poisson-Boltzmann equations on irregular domains, some variational problems, augmented approach for interface problems and problems on irregular domains.

DTIC

Computational Fluid Dynamics; Magnetorheological Fluids; Nonlinearity; Numerical Analysis

20080003041 Naval Postgraduate School, Monterey, CA USA

Finite Element Based Structural Damage Detection Using Artificial Boundary Conditions

Lagunes Arteaga, Rafael A; Sep 2007; 183 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474169; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474169>

Finite element models can be used to discern the location and severity of damage in structures. This is frequently pursued by using the differences in measured and computed natural frequencies, in conjunction with the sensitivities calculated using the FE model. Given that a modal test produced a limited number of natural frequencies for a structure, the concept of Artificial Boundary Conditions (ABC) was developed, which yields additional natural frequency information for a structure. This is accomplished by artificially imposing additional boundary conditions to the measured data. In this thesis, the use of ABC to produce an improved set of structural sensitivities is explored. It is shown that the selection of ABC sets is best guided by the strain energy distribution in the structure.

DTIC

Boundary Conditions; Damage; Detection; Finite Element Method; Kinetic Energy

20080006344 Defence Research and Development Canada, Valcartier, Quebec Canada

Complexity and Chaos - State-of-the-Art; Formulations and Measures of Complexity

Couture, Mario; Sep 2007; 78 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475276; DRDC-V-TN-2006-451; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Different formulations and measures that may be used for evaluating the complexity of systems are gathered in this Technical Note. They might be useful for describing aspects of military complex systems. They were extracted from documents issued from the scientific literature related to Complexity Theory, chaos and complex systems.

DTIC

Chaos; Complex Systems

70
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*.

20080003109 Kettering Univ., Flint, MI USA

High-Fidelity Real Gas Model for RF Excited Plasma Flow Control

Subrata, Roy; Aug 10, 2007; 16 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0074

Report No.(s): AD-A474248; KU-530140; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We demonstrate the prediction capability a self consistent finite-element formulation for mitigating inert gas flow separation using rf-driven dielectric barrier discharge. Specifically, several physical and geometric parameters such as the amplitude and shape of excitation, dielectric constants, initial ionization level, and electrode shape are studied. The effect of polyphase power supply to an array of actuators has also been explored. It is found that (1) favorable ranges of frequency and electric field exist for most effective flow control, (2) the momentum transfer to the neighboring gas is cumulative for an optimum phase angle and distance between the exposed electrodes. Also streamwise momentum transfer does not keep on increasing with the number of actuators. We extend our work towards developing a multidimensional first principles theoretical model of the non-equilibrium real gas discharge. The electric force field generated by asymmetrically arranged plasma actuator We have worked in close collaboration with Dr. Datta Gaitonde (VAAC/AFRL) code and to simulate electrodynamic mitigation of three-dimensional wing stall about a symmetric airfoil. These efforts set the basis for active flow control over a vehicle forebody.

DTIC

Coding; Excitation; Magnetohydrodynamic Flow; Radio Frequencies; Real Gases

20080003142 Air Force Research Lab., Wright-Patterson AFB, OH USA

The Relationship Between Chemical Structure and Dielectric Properties of Plasma-Enhanced Chemical Vapor Deposited Polymer Thin Films (Postprint)

Eyink, Kurt; Enlow, Jesse; Bunning, Timothy J; Jiang, Hao; Hong, Lianggou; Venkatasubramanian, N; Grant, John T; Wiacek, Kevin; Fries-Carr, Sandra; Jan 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474335; AFRL-ML-WP-TP-2007-559; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Polymer dielectric films fabricated by plasma enhanced chemical vapor deposition (PECVD) have unique properties due to their dense crosslinked bulk structure. These spatially uniform films exhibit good adhesion to a variety of substrates, excellent chemical inertness, high thermal resistance, and are formed from an inexpensive, solvent-free, room temperature process. In this work, we studied the dielectric properties of plasma polymerized (PP) carbon-based polymer thin films prepared from two precursors, benzene and octafluorocyclobutane. Two different monomer feed locations, directly in the plasma zone or in the downstream region (DS) and two different pressures, 80 Pa (high pressure) or 6.7 Pa (low pressure), were used. The chemical structure of the PECVD films was examined by X-ray photoelectron spectroscopy and Fourier-transform infrared spectroscopy. The dielectric constant and dielectric loss of the films were investigated over a range of frequencies up to 1 MHz and the dielectric strength (breakdown voltage) (F_b) was characterized by the current-voltage method. Spectroscopic ellipsometry was performed to determine the film thickness and refractive index. Good dielectric properties were exhibited, as PP-benzene films formed in the high pressure, DS region showed a F_b of 610 V/microns, a dielectric constant of 3.07, and a dielectric loss of 7.0×10^{-3} (power) at 1 kHz. The PECVD processing pressure has a significant effect on final film structure and the film's physical density has a strong impact on dielectric breakdown strength. Also noted was that the residual oxygen content in the PP-benzene films significantly affected the frequency dependences of the dielectric constant and loss.

DTIC

Chemical Composition; Dielectric Properties; Fabrication; Plasmas (Physics); Thin Films; Vapor Deposition

20080003167 Naval Postgraduate School, Monterey, CA USA

Vibration Analysis via Wireless Network

Wallis, David C; Sep 2007; 87 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis addresses the problem of early detection of fault conditions in an air compression system. Initially, pressure transducers, and MaxStream ZigBee devices, were utilized to provide data to a remote GUI interface through wireless data transmission. The research also included a study of vibration analysis utilizing a Kullback-Lieber algorithm for spectral distance. This algorithm was programmed in LabView 8.0 using the FFT at the point of measurement to process the raw data obtained from a set of accelerometers. The results of the FFT were wirelessly transmitted to an end node where a LabView program processed the Kullback-Lieber algorithm to obtain a spectral distance value. This value was then compared to a reference value to ascertain whether the bearings on a particular piece of equipment required maintenance. The expected contribution from this research is to highlight the capability for greater wireless capability aboard U.S. Naval vessels. Wireless networks offer an inexpensive, reliable, survivable method for leveraging the power of information throughout the ship. Additionally, there are significant advantages to be realized through the reduction of manpower assigned to the repetitive and highly error-prone process of monitoring the thousands of sensors aboard any naval vessel.

DTIC

Communication Networks; Dynamic Structural Analysis; Radiotelephones; Vibration

20080003198 Air Force Research Lab., Wright-Patterson AFB, OH USA

Theory of Second Harmonic Generation in Presence of Diffraction, Beam Walk-off and Pump Depletion

Guha, Shekhar; Gonzalez, Leonel P; Mar 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474439; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Integral expressions for the pump and generated fields are presented here for the case of second harmonic generation of a focused Gaussian pump beam incident on a nonlinear crystal. The birefringent walk-off of the generated beam and the effect of pump depletion are included in the theory.

DTIC

Depletion; Diffraction; Harmonic Generations

20080003336 Texas Univ., San Antonio, TX USA

Kinetics Based Reaction Modeling for Heterogeneous Explosives

Clutter, J K; Jun 1, 2007; 70 pp.; In English

Contract(s)/Grant(s): F08630-02-1-0003; Proj-2502

Report No.(s): AD-A474367; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mechanical and chemical processes that occur in the explosives found in munitions systems are important to the entire life cycle of the system. Examples of these processes are found in the accidental detonation of weapons while in storage or transport, the premature initiation of a warhead during employment, and the destructive output from the system when functioned as designed. The complete range of possible processes encompasses a wide variety of chemical and mechanical phenomena and depending on the scenario, the dominant phenomenon changes. An essential tool for the design and analysis of these systems is a computational model that can predict a range of scenarios. It is such a tool that is the focus of this proposed effort.

DTIC

Detonation; Explosives; Heterogeneity; Kinetics; Mathematical Models

20080005221 Michigan Univ., Ann Arbor, MI USA

Studies of Spin Amplifier for Logic Applications

Bhattacharya, Pallab; Nov 2007; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9550-07-1-0305

Report No.(s): AD-A474481; UM/EECS-055035; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474481>

A ferromagnet/semiconductor based electrically controlled spin-current amplifier using a dual-drain non-local lateral spin valve was demonstrated. The spin polarization injected by the source into the channel was amplified at the second drain contact. An amplified current spin polarization of 100% was measured. The device provided controlled spin-current gain,

which was varied in the entire range from -1 to +1. The controlled variation of amplifier gain with bias was also demonstrated. The maximum operating temperature of the device was as high as 150 K. A pure spin-current generation with zero charge current was also demonstrated using this device. This was the first experimental demonstration of a spin-current amplifier. The observations were explained in the framework of the spin drift-diffusion model. The principle of operation of the device was very generic and could be adapted to any ferromagnet/semiconductor heterostructure system.

DTIC

Amplification; Amplifiers; Particle Spin; Quantum Numbers

20080005224 Vermont Univ., Burlington, VT USA

A Research Program on the Asymptotic Description of Electromagnetic Pulse Propagation in Spatially Inhomogeneous, Temporally Dispersive, Attenuative Media

Oughstun, Kurt E; Cartwright, Natalie A; Sep 2007; 8 pp.; In English

Contract(s)/Grant(s): FA9550-06-1-0268; Proj-2304

Report No.(s): AD-A474484; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474484>

The high frequency, low power characteristics of ultrawideband/short-pulse signals exhibit uniquely promising features with applications to remote sensing of terrestrial objects from satellites, foliage-penetrating radar, as well as the study of biological tissue exposed to ultrawideband pulses. Indeed, previous studies of ultrawideband electromagnetic pulse propagation through dispersive, nonconducting media has shown the existence of a so-called Brillouin precursor whose peak amplitude only decays algebraically with propagation distance. However, materials such as the ionosphere, foliage and biological tissue exhibit conductivity. In this paper, we show that a Debye model material with static conductivity does indeed support a Brillouin precursor, but that this precursor now attenuates exponentially with propagation distance and not just algebraically. Nevertheless, we show that it is still advantageous to track the Brillouin precursor in remote sensing applications because its attenuation is less than the attenuation of exponentially with propagation distance and not just algebraically. Nevertheless, we show that it is still advantageous to track the Brillouin precursor in remote sensing applications because its attenuation is less than the attenuation of the main signal.

DTIC

Attenuation; Dispersing; Electromagnetic Pulses; Electromagnetic Wave Transmission

20080006100 Georgetown Univ., Washington, DC USA

Theoretical Modeling of 10K and 30K Josephson Junctions

Freericks, James K; Dec 17, 2007; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-05-1-0078

Report No.(s): AD-A474998; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474998>

This is the final report for grant N00014-05-1-0078. Work was completed on a number of projects including developing a multiband multilayered inhomogeneous dynamical mean-field theory code for analyzing properties of magnesium diboride junctions. In addition, work was completed on how one can use a generalized Thouless energy to describe properties of Josephson junctions, and on the nonlinear response of strongly correlated materials to large electric fields. The PI was also involved in two successful CAP projects with the HPCMO. Finally, a textbook entitled 'Transport in Multilayered Nanostructures: The Dynamical Mean-Field Theory Approach' was published by Imperial College Press.

DTIC

Josephson Junctions; Mathematical Models

20080006107 Air Force Research Lab., Wright-Patterson AFB, OH USA

The Structure and Dielectric Properties of Plasma-Polymerized Benzene and OFCB Thin Films (Preprint)

Jiang, Hao; Hong, Lianggou; Venkatasubramanian, N; Grant, John T; Eyink, Kurt; Wiacek, Kevin; Fries-Carr, Sandra; Enlow, Jesse; Bunning, Timothy J; Sep 2006; 5 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475005; AFRL-ML-WP-TP-2007-536; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475005>

Polymeric dielectric and photonic thin films can be fabricated using plasma enhanced chemical vapor deposition

(PECVD), a room temperature, solvent-free and versatile technique. Many organic precursors have been deposited yielding plasma polymerized thin films with a wide range of functionalities. These films, exhibiting highly cross-linked structures, pin-hole free bulk morphologies and smooth surfaces for a variety of film thicknesses, have been targeted for optical and dielectric applications such as waveguides, AR coatings, band-gap filters for integrated optics, and high performance dielectric devices. In this work, benzene and octafluorocyclobutane (OFCB) were chosen as starting precursors for exploring the relationship between structure and dielectric properties.

DTIC

Benzene; Dielectric Properties; Optical Properties; Plasmas (Physics); Polymerization; Thin Films; Vapor Deposition

20080006338 Army Engineer Research and Development Center, Vicksburg, MS USA

Boussinesq Modeling of Wave Propagation and Runup over Fringing Coral Reefs, Model Evaluation Report

Demirbilek, Zeki; Nwogu, Okey G; Dec 2007; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475264; ERDC/CHL-TR-07-12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report describes evaluation of a two-dimensional Boussinesq-type wave model, BOUSS-2D, with data obtained from two laboratory experiments and two field studies at the islands of Guam and Hawaii, for waves propagating over fringing reefs. The model evaluation had two goals: (a) investigate differences between laboratory and field characteristics of wave transformation processes over reefs, and (b) assess overall predictive capabilities of the model for reef systems with steep slopes and extended widths in shallower water. The focus in this evaluation study was on wave breaking, bottom friction parameterization, and wave setup and runup capabilities of Boussinesq wave model. In this report, the testing procedure and performance of the Boussinesq wave model are discussed. Because details of the laboratory and field studies were unavailable at the time of writing, and these are expected to be documented in other reports, only some general features of data pertinent to the numerical modeling study are presented. The time series of laboratory and field data were used in the numerical model validation study. These were converted to wave energy spectral densities, significant wave height, peak wave period, and mean water level setup for comparison to model predictions. Findings from comparisons of measurements and model calculations are presented in figures and tables, and these are supplemented as necessary with discussion of the model's capability in describing different wave processes over coral reefs. Overall, the model performed reasonably well for laboratory data with errors of less than 10 percent for the maximum runup height. For the field data, it was determined that wave energy dissipation over extremely rough coral reef surfaces could not be simply described by a quadratic bottom friction law.

DTIC

Coral Reefs; Mathematical Models; Wave Propagation

71 ACOUSTICS

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*.

20080002945 Army Research Lab., Adelphi, MD USA

Tracking Targets of Interest Via Acoustics

Solomon, Latasha; Tran-Luu, Duong; Oct 2007; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473938; ARL-TR-4307; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473938>

Current military operations require robust signal-processing algorithms that allow for hostile fire defeat in reverberant environments. These algorithms must provide the individual Soldier with real-time situational awareness and actionable intelligence. Sensor configuration, terrain features, and atmospheric conditions must be considered when one is developing such algorithms. This report analyzes localization results of a novel signal-processing technique used to localize and track acoustic mortar data during a recent field experiment.

DTIC

Acoustics; Targets

20080003130 Naval Research Lab., Bay Saint Louis, MS USA

Shallow Water Environmental Profiler in Trawl-Resistant Real-Time Configuration (SEPTR) Used for Frontal Dynamics Research

Book, Jeffrey W; Rixen, Michel; Carta, Alessandro; Hulbert, Mark S; Quaid, Andrew J; Coelho, Emanuel; Grandi, Vittorio; Gualdesi, Lavinio; Apr 2007; 2 pp.; In English

Report No.(s): AD-A474301; NRL/PP/7330-06-7037; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During both a winter and summer period of 2006, SEPTR moorings were used for real-time monitoring of velocity, temperature, salinity, waves, and optics in a dynamic frontal zone of the central Adriatic Sea. From the trawl-resistant, barnacle-like shaped SEPTR housings, velocities were measured acoustically. Other water column parameters were measured four times a day through a CTD profiler that was released to the surface and winched back into the protective mooring housing. Thus, all variables of dynamic significance were monitored synoptically across a heavily fished coastal frontal zone.

DTIC

Acoustic Measurement; Adriatic Sea; Ocean Currents; Real Time Operation; Shallow Water

20080003145 Scripps Institution of Oceanography, La Jolla, CA USA

Shallow Water MCM and ASW Using Off-Board, Autonomous Sensor Networks and Multistatic, Time-Reversal Acoustics

Song, H-C; Gerstoft, P; Kuperman, W A; Hodgkiss, W S; Nov 16, 2007; 8 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0012

Report No.(s): AD-A474340; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This was a joint project with MIT, Henrik Schmidt et al 'separate ONR proposal' and SACLANTCEN 'Stevenson and Jensen'. The long term goals are to develop environmentally adaptive bi- and multi-static sonar concepts for autonomous off-board sensor networks for the detection and classification of proud, buried and waterborne targets in shallow water. SACLANTCEN provided three weeks of simultaneous sea time for both the R/V Alliance and R/V Leonardo during July 2004. MPL'S main contribution was to develop and test signal processing algorithms.

DTIC

Acoustics; Autonomy; Shallow Water; Signal Processing; Sonar

20080003200 Washington Univ., Seattle, WA USA

Holographic Array Processing in the Ocean

Al-Kurd, Azmi A; Mar 1, 1993; 155 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-90-J-1369

Report No.(s): AD-A474441; APL-UW-TR-9306; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation provides detailed analysis, performance evaluation, and modeling of a source localization method that is based on medium calibration. In the past, processing the signals received on an array of sensors in the ocean to locate an acoustic source has been treated by methods which are based on detailed knowledge of the sound speed structure between the source and the receiving array.

DTIC

Acoustic Velocity; Calibrating; Detectors; Holography; Oceans; Signal Processing

20080003272 Department of the Navy, Washington, DC USA

Increased Effective Aperture for Receive Arrays

Ruffa, Anthony A, Inventor; Aug 24, 2005; 15 pp.; In English

Report No.(s): AD-D020315; No Copyright; Avail.: Other Sources

A sonar dome having an acoustic array housed therein. A plurality of bubbles are generated within the fluid inside the sonar dome. The generated bubbles are of an amount and size to reduce the speed of sound within the sonar dome fluid. Reduction of the speed of sound within the sonar dome fluid effectively increases the aperture of the acoustic array. The bubbles can be generated from a gas source or electrolytically. Typically, each individual bubble is less than 0.01 mm in diameter to reduce bubble velocity in the fluid.

DTIC

Acoustic Measurement; Acoustic Velocity; Apertures; Arrays; Sonar

20080005208 NASA Glenn Research Center, Cleveland, OH, USA

Acoustic Prediction State of the Art Assessment

Dahl, Milo D.; October 30, 2007; 47 pp.; In English; NASA Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.02; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005208>

The acoustic assessment task for both the Subsonic Fixed Wing and the Supersonic projects under NASA's Fundamental Aeronautics Program was designed to assess the current state-of-the-art in noise prediction capability and to establish baselines for gauging future progress. The documentation of our current capabilities included quantifying the differences between predictions of noise from computer codes and measurements of noise from experimental tests. Quantifying the accuracy of both the computed and experimental results further enhanced the credibility of the assessment. This presentation gives sample results from codes representative of NASA's capabilities in aircraft noise prediction both for systems and components. These include semi-empirical, statistical, analytical, and numerical codes. System level results are shown for both aircraft and engines. Component level results are shown for a landing gear prototype, for fan broadband noise, for jet noise from a subsonic round nozzle, and for propulsion airframe aeroacoustic interactions. Additional results are shown for modeling of the acoustic behavior of duct acoustic lining and the attenuation of sound in lined ducts with flow.

Author

Fixed Wings; Aeroacoustics; Interactional Aerodynamics; Noise Prediction; Acoustic Attenuation; Ducts; Noise Measurement

20080005215 Naval Postgraduate School, Monterey, CA USA

Maritime Surveillance Using a Wideband Hydrophone

Wilson, Jason K; Sep 2007; 69 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474472; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Undersea acoustic moderns acquire wideband acoustic time series through an electro-acoustic transducer and use on-board digital signal processing for receiving acoustic communications. These component devices can potentially serve a dual use for passive sensing of radiated acoustic energy from maritime vessels. This thesis examines the characteristic Lloyd's mirror interference pattern present in the acoustic spectrogram of a passing surface target and applies two-path ray theory and waveguide invariant theory to an analysis of the phenomenon. The two theories are shown to be mathematically equivalent under certain conditions. In combination with the Doppler shift from a target tonal, these theories permit a calculation of target range and speed at the closest point of approach (CPA). Such analysis is applied to spectrograms obtained in a controlled experiment at the approaches to San Diego Bay. For targets passing within 185 meters of the receiver, the resulting Lloyd's mirror pattern permits calculation of the range to within 9%. Target speed obtained from the Doppler shift is within 4% of the ground truth value.

DTIC

Acoustics; Broadband; Communication; Hydrophones; Sound Transmission; Surveillance; Underwater Acoustics

20080005238 Army Research Lab., Aberdeen Proving Ground, MD USA

Topics in the Analysis of Shear-Wave Propagation in Oblique-Plate Impact Tests

Scheidler, Mike; Sep 2007; 26 pp.; In English

Contract(s)/Grant(s): Proj-AH43

Report No.(s): AD-A474522; ARL-SR-157; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report addresses several topics in the theoretical analysis of shock waves, acceleration waves, and centered simple waves, with emphasis on the propagation of shear waves generated in oblique-plate impact tests. The first report, 'Formulas for the Pressure and Bulk Modulus in Uniaxial Strain,' demonstrates that for a general, nonlinear, isotropic elastic solid, the shear stress in the uniaxially strained region ahead of the shear wave may be inferred from the measured shear-wave speed and the density. This result, which improves on approximate analyses in the literature, is applied to the study of fused silica in the shocked state. The second report, Response of Nonlinear Elastic Solids to Oblique-Plate Impact, treats the case where the shear wave is a centered simple wave (or ramp wave). Approximate relations are derived for the stress, strain, particle velocity, wave speed, and rise time, and applications to material characterization are discussed. The third report, Universal Relations for Pressure-Shear Waves in Nonlinear Elastic Solids, treats centered simple shear waves and shear shocks. Here, we obtain approximate relations between stress, strain, particle velocity, and wave speeds that do not explicitly involve the constitutive functions or elastic constants of the material. The fourth report, Approximate Universal Relations Between Shock and Acceleration Wave Speeds for Oblique Plate Impact of Inelastic Solids, extends some of the results of the previous report to a large class of inelastic solids, although a completely different method of proof is required for the inelastic case. The results

of the latter three reports apply not only to isotropic solids but also to certain anisotropic solids, provided that the symmetry axes are appropriately aligned with the test geometry.

DTIC

Bulk Modulus; Impact Tests; S Waves; Shear Stress; Shock Waves; Wave Propagation

20080005487 Department of the Navy, Washington, DC USA

Ultra Compact Receiver

Ruffa, Anthony A, Inventor; Jul 27, 2007; 11 pp.; In English

Report No.(s): AD-D020316; No Copyright; Avail.: Other Sources

This patent application discloses a combination Amplitude Modulation (AM) receiver and sound reproducer. A hollow sphere (or cylinder) of piezoelectric material coated with a thin conductive layer is configured such that it receives the electromagnetic energy associated with an AM signal. The thickness of the piezoelectric material is selected to resonate at the AM signal's carrier frequency.

DTIC

Ceramics; Electromagnetic Fields; Patent Applications; Piezoelectricity; Radio Receivers; Receivers; Signal Reception; Signal Transmission; Sound Generators; Sound Waves

20080005538 NASA Glenn Research Center, Cleveland, OH, USA

Acoustics Discipline Overview

Envia, Edmane; Thomas, Russell; October 30, 2007; 33 pp.; In English; Fundamental Aeronautics Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.'8.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005538>

As part of the Fundamental Aeronautics Program Annual Review, a summary of the progress made in 2007 in acoustics research under the Subsonic Fixed Wing project is given. The presentation describes highlights from in-house and external activities including partnerships and NRA-funded research with industry and academia. Brief progress reports from all acoustics Phase 1 NRAs are also included as are outlines of the planned activities for 2008 and all Phase 2 NRAs. N+1 and N+2 technology paths outlined for Subsonic Fixed Wing noise targets. NRA Round 1 progressing with focus on prediction method advancement. NRA Round 2 initiating work focused on N+2 technology, prediction methods, and validation. Excellent partnerships in progress supporting N+1 technology targets and providing key data sets.

Derived from text

Acoustics; Fixed Wings; Prediction Analysis Techniques; Targets

20080005574 NASA Glenn Research Center, Cleveland, OH, USA

JET Noise Prediction

Goldstein, M. E.; Leib, S. J.; December 04, 2007; 9 pp.; In English; Fall 2007 Acoustics Technical Working Group Meeting, 4-5 Dec. 2007, Cleveland, OH, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.04; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005574>

Aerodynamic noise prediction has been an important and challenging research area since James Lighthill first introduced his Acoustic Analogy Approach over fifty years ago. This talk attempts to provide a unified framework for the subsequent theoretical developments in this field. It assumes that there is no single approach that is optimal in all situations and uses the framework as a basis for discussing the strengths weaknesses of the various approaches to this topic. But the emphasis here will be on the important problem of predicting the noise from high speed air jets. Specific results will presented for round jets in the 0.5 to 1.4 Mach number range and compared with experimental data taken on the Glenn SHAR rig. It is demonstrated that non-parallel mean flow effects play an important role in predicting the noise at the supersonic Mach numbers. The results explain the failure of previous attempts based on the parallel flow Lilley model (which has served as the foundation for most jet noise analyses during past two decades).

Author

Jet Aircraft Noise; Aeroacoustics; Mathematical Models; Noise Prediction (Aircraft); Jet Flow

20080005581 NASA Glenn Research Center, Cleveland, OH, USA

Ultra High Bypass Ratio Engine Research for Reducing Noise, Emissions, and Fuel Consumption

Hughes, Christopher E.; Schweitzer, Jeff; October 30, 2007; 12 pp.; In English; Fundamental Aeronautics 2007 Annual Meeting, 30 Oct. - 1 Nov. 2007, New Orleans, LA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.18.04; Copyright; Avail.: CASI: A03, Hardcopy

A pictorial history of NASA development of advanced engine technologies for reducing environmental emissions and increasing performance from the 1970s to 2000s is presented. The goals of the Subsonic Fixed Wing Program portion of the NASA Fundamental Aeronautics Program are discussed, along with the areas of investigation currently being pursued by the Ultra High Bypass Partnership Element of the Subsonic Fixed Wing Program.

Author

Bypass Ratio; Fuel Consumption; Noise Reduction; Exhaust Emission; Aircraft Design; NASA Programs; Fixed Wings; Subsonic Aircraft; Histories

20080005665 Florida Univ., Gainesville, FL USA

MIMO Underwater Acoustic Communications for Rate Enhancement and Range Extension

Yang, Liuqing; Li, Jian; Dec 10, 2007; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-07-1-0193

Report No.(s): AD-A474814; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Our research focuses on the horizontal underwater acoustic communications. For high data rate applications, such as image transmission or multiuser networks at long ranges, coherent underwater acoustic communication is of great importance. In this direction, we consider multi-input multi-output (MIMO) transmit beamforming under the uniform elemental power constraint. This is a non-convex optimization problem, and the optimal transmit beamformer is usually difficult to construct. We will first find a beamforming solution in an ideal setup, and then consider practical finite-rate feedback methods required to implement the transmit beamforming. On the other hand, the highly time-varying and frequency-selective underwater acoustic channel consists of a great challenge for channel estimators necessary for coherent communications. Such difficulty is aggravated when multiple transducers and/or hydrophones are deployed. Therefore, we also investigate differential MIMO transmission and reception approaches tailored for doubly-selective MIMO channels. To enhance the system error performance, we notice that the three-dimensional space-time-frequency variation of the underwater channel can be exploited to provide three-dimensional diversity gain. Based on all these, we also develop a differential MIMO transceiver tailored for doubly-selective underwater channels.

DTIC

Acoustics; Augmentation; Beamforming; Communication; MIMO (Control Systems); Sound Transmission; Underwater Acoustics; Underwater Communication

20080005680 Army Construction Engineering Research Lab., Champaign, IL USA

An Investigation of Community Attitudes Toward Blast Noise: Methodology

Pater, Larry L; Nykaza, Edward T; Luz, George; Atchley, Anthony; Hodgdon, Kathleen; Baumgartner, Robert; Rathbun, Pamela; Oct 2007; 40 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474855; ERDC/CERL-SR-07-24; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The military has determined that current blast noise impact assessment procedures do not fully meet the military's noise management needs. Noise impacts are almost universally assessed in terms of the response metric 'annoyance' as predicted by a long-term average noise level metric. This has proven to be unsatisfactory for extremely variable impulsive military noise. Individual event noise levels from military testing and training activities can be loud enough to elicit negative community response, and even loud enough to exceed the human hearing damage threshold. Yet when events are averaged over a year's time, the average level meets established acceptability criteria. The objective of this project is to provide a research methodology for improving the current human response to blast noise assessment procedures. More specifically, this report outlines an approach to enhance understanding of human response to blast noise, and to determine a methodology to accurately predict human response to impulsive military noise. This methodology will provide reliable and practicable guidance for noise impact management decisions.

DTIC

Acceptability; Damage Assessment; Impact; Impulses; Psychometrics

20080005822 Naval Postgraduate School, Monterey, CA USA

Obstacle Detection and Avoidance Using Blazed Array Forward Look Sonar

Healey, A J; Horner, D P; Kragelund, S P; Sep 30, 2006; 10 pp.; In English

Contract(s)/Grant(s): MIPR-N0001406WR20060

Report No.(s): AD-A474842; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long term goal of this project is to increase the level of autonomy in AUVs as they are being used for more complex missions than mine countermeasures. Part of this increase in autonomy will rely on obstacle detection and avoidance and will require a forward looking sonar (FLS) suitable for small vehicles. In the past year, the NPS Center for AUV Research has mounted a University of Washington Applied Physics Lab (UW:APL) Blazed Array Forward Looking Sonar (FLS) on the NPS ARIES AUV and has conducted several data collection tests in Monterey Bay. The goal of the project is to develop Obstacle Avoidance (OA) algorithms for small AUVs using image analysis in a dynamic real time system for detection and avoidance. DTIC

Autonomy; Avoidance; Obstacle Avoidance; Sonar; Underwater Vehicles

20080006060 NASA Glenn Research Center, Cleveland, OH, USA

Fan Rig Noise Spectral Correction for NASA 9'x 15' Low-Speed Wind Tunnel

Schifer, Nick; Brown, Cliff; December 04, 2007; 23 pp.; In English; Technical Working Group 2007, 4-5 Dec. 2007, Cleveland, OH, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.18.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006060>

Aircraft engine noise research and development depends on the ability to study and predict the noise created by each engine component in isolation. Fan noise testing, however, requires a significant support system including a drive mechanism to turn the fan, a device to smooth the flow into the fan, and a stand to raise the fan off the ground each of which has the potential to create its own noise. A methodology was therefore developed to improve the data quality for the 9x15 Low Speed Wind Tunnel (LSWT) at the NASA Glenn Research Center that identifies three noise sources: fan noise, jet noise, and rig noise. The jet noise and rig noise was then measured by mounting a scale model of the 9x15 LSWT setup in a jet rig to simulate everything except the rotating machinery that characterizes fan noise. The data showed that the spectra measured in the LSWT has a strong rig noise component at frequencies as high as 3 kHz depending on the fan and speed. The jet noise was determined to be significantly lower than the rig noise. A mathematical model for the rig noise was then developed using a multi-dimensional least squares fit to the rig noise data. This allows the rig noise to be subtracted or removed, depending on the amplitude of the rig noise relative to the fan noise, at any given frequency, observer angle, or nozzle pressure ratio. The impact of isolating the fan noise with this method on spectra, overall power level (OAPWL), and Effective Perceived Noise Level (EPNL) is studied.

Author

Low Speed Wind Tunnels; Fan Blades; Effective Perceived Noise Levels; Noise Intensity; Jet Aircraft Noise; Engine Noise; Support Systems; Pressure Ratio

20080006071 NASA Glenn Research Center, Cleveland, OH, USA

Noise Characteristics of Overexpanded Jets from Convergent-Divergent Nozzles

Zaman, K. B. M. Q.; January 07, 2008; 12 pp.; In English; 46th AIAA Aerospace Sciences Meeting, 7-11 Jan. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 984754.02.07.03.17.04

Report No.(s): AIAA Paper-2008-25; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006071>

A broadband noise component occurring in the overexpanded flow regime with convergent-divergent nozzles is identified. Relative to a convergent nozzle, at same pressure ratios, this excess noise can lead to a large increase in the overall sound pressure levels. Several features distinguish it from the more familiar broadband shock associated noise. Unlike the latter, it is observed even at shallow polar locations and there is no noticeable shift of the spectral content in frequency with observation angle. The amplitudes are found to be more pronounced with nozzles having larger half-angle of the divergent section. The noise apparently occurs when a shock resides within the divergent section of the nozzle and results from random unsteady motion of the shock.

Author

Broadband; Convergent-Divergent Nozzles; Noise Measurement; Aeroacoustics; Jet Flow

20080006086 Naval Surface Warfare Center, Bethesda, MD USA

Acoustic Doppler Current Profiler (ADCP) Velocity Verification Experiments in the Navy's Large Cavitation Channel (LCC)

Chirchella, Dylan A; Dec 2007; 38 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474970; NSWCCD-50-TR-2007-039; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474970>

The Resistance and Powering Division (Code 5200) of The Naval Surface Warfare Center, Carderock Division (NSWCCD) conducted verification experiments on a 20 degree Acoustic Doppler Current Profiler (ADCP) unit produced by RD Instruments (RDI) of San Diego, California. These experiments were conducted in the Navy's Large Cavitation Channel (LCC) located in Memphis, Tennessee. Although they have many other possible future uses, currently the ADCP units tested during this series are used to profile flow and determine speed through the water on ships during at-sea trials. The purpose of this Report is to present the accuracy of the ADCP units in determining speed through the water. Data collected with the ADCP units are compared to data collected by the LCC's Laser Doppler Anemometer (LDA) system, which provides highly accurate water velocity data. The experimental results indicate excellent agreement between the ADCP and LDA. Based on the experimental results, it is recommended that the ADCP is operated using water mode 12 and an ambiguity velocity of 700 cm/s during future sea trials. The experimental results indicate the ADCP agrees with LDA within +/-0.2 knots on average when these settings are used.

DTIC

Cavitation Flow; Doppler Effect; Laser Anemometers

20080006090 Mississippi Univ., University, MS USA

False Indicators to Acoustic-To-Seismic Buried Landmine Detection

Sabatier, James M; Nov 28, 2007; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-02-1-0878

Report No.(s): AD-A474976; NCPA-JS1107-01; NCPA-JMS1207-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474976>

The proliferation of relatively cheap landmines in many of the world's conflicts has led to a critical situation. Most methods of locating landmines trigger on too many false alarms must each be investigated before declaring an area to be clear of mines. This led to the need for an accurate means of detection coupled with a low false alarm rate. The University of Mississippi has developed an acoustic/seismic technique to meet this need. In 2002, the Office of Naval Research issued Grant N00014-02-1-0878 to conduct research to better understand the causes of false alarms using this method and to develop methods to significantly reduce them. This report discusses the significant research advances including a clearer understanding of the phenomenology underlying the technology, development of models, and signal processing techniques to reduce false alarms.

DTIC

False Alarms; Mine Detectors; Sound Detecting and Ranging

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*.

20080005222 Stanford Univ., Stanford, CA USA

Studies with Laser Cooled Atoms and Single Molecules

Chu, Steven; Sep 2007; 20 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0040; Proj-2301

Report No.(s): AD-A474482; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474482>

We have achieved milestones in atom interferometry. By using multiphoton Bragg diffraction to make beam splitters that transfer the momentum of up to 24 photons to the atoms, we are able to increase the signal by a factor of 12 for Mach-Zehnder or 144 for Ramsey-Borde Interferometers relative to the 2-photon beam splitters used in the best present interferometers. We

are also able to run Ramsey-Borde interferometers simultaneously to suppress the influence of vibrations. Work continues to make the experimental setup reliable, as required for routine data taking and tracking down systematic effects at the 0.1 parts per billion level of precision.

DTIC

Atoms; Cooling; Lasers; Molecules

20080005256 Texas A&M Univ., College Station, TX USA

Quantum Optical Implementations of Quantum Computing and Quantum Informatics Protocols

Scully, Marlan O; Zubairy, M S; Nov 20, 2007; 26 pp.; In English

Contract(s)/Grant(s): FA9550-04-1-0206

Report No.(s): AD-A474560; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474560>

An enumeration of several research efforts funded by the above award is attached. Key aspects reported on include: (a) Sub-wavelength lithography, (b) Subwavelength atom localization, (c) Coherence-induced entanglement and entanglement amplification, (d) Measurement of an arbitrary entangled state, (e) Implementation of optical associative memory, (f) Optically controlled delays for broadband pulses and all-optical beam steering, (g) Measurement of the separation between molecules beyond classical limit, (i) From quantum eraser to Maxwell's demon, (j) Atom microscopy beyond Rayleigh limit, (k) Entanglement criteria, (l) Single-atom laser as a source of entangled light.

DTIC

Optical Computers; Optical Data Processing; Protocol (Computers); Quantum Computation; Quantum Optics

20080005627 Indian Inst. of Tech., Roorkee, India

Electron Impact Excitation Cross Sections of Xenon for Optical Plasma Diagnostic

Srivastava, Rajesh; Nov 20, 2007; 21 pp.; In English

Contract(s)/Grant(s): FA4869-06-1-0044

Report No.(s): AD-A474795; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474795>

In this project the researcher had taken up the calculation of xenon apparent emission-excitation cross sections for emission lines that have diagnostic value in the analysis of Xe-propelled electric thruster plasmas. Following conclusions were made from the study: The RDW method has been shown to be applicable to transitions between excited states. Since the excitation energy of these transitions is relatively small, first-order theories are valid at lower energies than for excitations from the ground states. The accuracy of the cross section depends crucially on the accuracy of the oscillator strengths obtained from the target wave functions. The use of a relativistic formalism 'j-j coupling' clearly explains the huge variation in the magnitudes of these cross sections. The objectives of the project have been achieved and the aimed metastable excitation cross section results of xenon were obtained that are required for the CRM model of Dressler and co-workers and these are being tested and new plasma modeling results are under calculation.

DTIC

Atomic Excitations; Electron Impact; Plasma Diagnostics; Plasmas (Physics); Xenon

20080005674 Indian Inst. of Tech., Kanpur, India

Quantum Well States in Fe/Nb(001) Multilayers: First Principles Study

Sliukia, Nitya N; Sen, A; Prasad, R; Dec 6, 2007; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA5209-06-P-0243

Report No.(s): AD-A474832; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A first principle study to understand the phenomena of interlayer exchange coupling in Fe/Nb multilayers using the linearized-muffin-tin-orbitals method within the generalized gradient approximation was performed. It was observed that the exchange coupling oscillates with both short and long periodicals, which have been examined in terms of Ruderman-Kittel-Kasuya-Yosida (RKKY) model as well as the Quantum well (QW) model. The behavior of the exchange coupling was investigated by artificially varying moments of Fe atoms in ferromagnetic layers. For small moments of Fe, the coupling shows bilinearity in the magnetic moments implying its RKKY character. However, at higher moments close to the bulk F, the saturation of long-period oscillations is in accordance with the QW model. Quantum well dispersions around the Fermi level demonstrate that the majority-spin bands contribute largely to the formation of quantum-well states, which was analyzed quantitatively by making use of the phase accumulation model. The analysis indicates that the quantum well model gives a

better description of the oscillatory behavior of the exchange coupling in Fe/Nb multilayers.

DTIC

Fermi Surfaces; Iron; Niobium; Quantum Wells

20080006120 Air Force Research Lab., Wright-Patterson AFB, OH USA

Combined Nonlinear Effects in Two-Photon Absorption Chromophores at High Intensities (Preprint)

Sutherland, Richard L; McLean, Daniel G; Brant, Mark C; Rogers, Joy E; Fleitz, Paul A; Urbas, Augustine M; Aug 2006; 17 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475022; AFRL-ML-WP-TP-2007-525; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475022>

Large two-photon and excited state absorption have been reported in donor-acceptor-substituted pi-conjugated molecules. We have performed detailed nonlinear absorption and photophysical measurements on a system of AFX chromophores and calculate the nonlinear transmission based on an effective three-level model. A numerical model that includes far wing linear absorption has been developed and compared with an analytical three-photon absorption model. The models are in accordance and yield excellent agreement with experimental nonlinear transmission data of 0.02-M AFX solutions up to laser intensities $\sim 1\text{GW}/\text{cm}^2$. Concentration effects at this intensity become increasingly evident. We have extended our modeling efforts to include some new effects that may be anticipated in this regime, such as stimulated scattering are included. We report on our experimental observations of various materials and discuss results with respect to our extended theoretical models.

DTIC

Chromophores; Nonlinearity; Photons

20080006137 Air Force Research Lab., Wright-Patterson AFB, OH USA

Insight into the Nonlinear Absorbance of Two Related Series of Two-Photon Absorbing Chromophores (Preprint)

Jakubiak, Rachel; Tan, Loon-Seng; Fleitz, Paul A; Rogers, Joy E; Slagle, Jonathan E; McLean, Daniel G; Sutherland, Richard L; Brant, Mark C; Heinrichs, Jim; Kannan, Ramamurthi; Jul 2006; 30 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475078; AFRL-ML-WP-TP-2007-538; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475078>

A comprehensive photophysical study has been carried out on two series of two-photon absorbing dyes. Looking at a series of structurally related chromophores provides insight into what controls the linear and nonlinear photophysical properties. These materials consist of an electron withdrawing benzothiazole group connected to a diphenylamine via a fluorene group. Within the series there are one-arm (dipolar), two-arm (quadrupolar), and three-arm (octupolar) versions of each dye. The one photon properties were studied using steady-state absorption, steady-state and time resolved emission, femtosecond transient absorption, and nanosecond transient absorption. The two-photon properties were studied using femtosecond Z-scan and nanosecond nonlinear transmittance. On the basis of a two photon assisted excited state absorption model we show that the excited state absorption from both the singlet and triplet excited states contributes to the overall nanosecond nonlinear absorption in these materials. In this study we determined that increasing the number of branches from one to three on the chromophore results in an increase in the overall nanosecond nonlinear absorption due to an increase in the excited state absorption.

DTIC

Chromophores; Nonlinearity; Photons

20080006317 Army Tank-Automotive Research and Development Command, Warren, MI USA

Modeling of SOC-700 Hyperspectral Imagery with the CAMEO-ESA Code

Evans, Roger; Oct 26, 2007; 20 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475209; RDECOM-18184; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The CAMEO-ESA software program provides a physics-based spectral radiance simulation over the complete range from UV to Far-IR, the only real limitation being one of obtaining the necessary input data. This paper investigates a CAMEO-ESA simulation of the visual and near-IR spectral range measured by the portable Surface Optics SOC-700 hyperspectral sensor. The FOV and spatial resolution of the sensor will also be modeled appropriately. A description of the SOC-700 hardware, the

SOC-700 data, the necessary CAMEO-ESA input data, the settings used for CAMEO-SIM, the CAMEO-ESA output, and a comparison of the hypercubes from each will be presented. The comparison will include the application of various hyperspectral analysis algorithms to both real and modeled data.

DTIC

Computerized Simulation; Imagery; Sim

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*.

20080002968 Library of Congress, Washington, DC USA

Managing the Nuclear Fuel Cycle: Policy Implications of Expanding Global Access to Nuclear Power

Nikitin, Mary B; Parillo, Jill M; Squassoni, Sharon; Andrews, Anthony; Holt, Mark; Nov 1, 2007; 45 pp.; In English
Report No.(s): AD-A473988; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473988>

After several decades of decline and disfavor, nuclear power is attracting renewed interest. New permit applications for 30 reactors have been filed in the USA, and another 150 are planned or proposed globally, with about a dozen more already under construction. In the USA, interest appears driven, in part, by provisions in the 2005 Energy Policy Act authorizing streamlined licensing that combine construction and operating permits, and tax credits for production from advanced nuclear power facilities. Moreover, the U.S. Department of Energy proposes to spend billions of dollars to develop the next generation of nuclear power technology. Expanding global access to nuclear power, nevertheless, has the potential to lead to the spread of sensitive nuclear technology. Despite 30 years of effort to limit access to uranium enrichment, several undeterred states pursued clandestine nuclear programs; the A.Q. Khan black market network's sales to Iran and North Korea representing the most egregious examples. Concern over the spread of enrichment and reprocessing technologies, combined with a growing consensus that the world must seek alternatives to dwindling and polluting fossil fuels, may be giving way to optimism that advanced nuclear technologies may offer proliferation resistance. Proposals offering countries access to nuclear power and thus the fuel cycle have ranged from a formal commitment by these countries to forswear enrichment and reprocessing technology, to a de facto approach in which a state does not operate fuel cycle facilities but makes no explicit commitment, to no restrictions at all. The most recent proposal under the U.S. Global Nuclear Energy Partnership (GNEP) represents a shift in U.S. policy by not requiring participants to forgo domestic fuel cycle programs.

DTIC

Nuclear Fuels; Nuclear Power Plants; Policies

20080003118 Library of Congress, Washington, DC USA

The Nuclear Nonproliferation Treaty Review Conference: Issues for Congress

Squassoni, Sharon; Behrens, Carl E; Apr 8, 2005; 21 pp.; In English

Report No.(s): AD-A474279; CRS-RL32857; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Member states of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) will meet in New York from May 2 to May 27, 2005, to review treaty implementation. These Review Conferences have taken place every 5 years since the treaty entered into force in 1970. In recent years, several developments have led many to believe that the nuclear nonproliferation regime needs to be strengthened: the discovery of the A.Q. Khan nuclear black market network; Iran's unreported nuclear activities, including secret uranium enrichment facilities; the withdrawal of North Korea from the NPT in April 2003; and the discovery of Libya's covert nuclear weapons program, renounced in December 2003. Brazilian Ambassador Sergio Duarte, who will chair the May Review Conference, suggested that the main difficulty facing the review conference will be how to balance a perceived need for greater controls with treaty provisions that ensure the right to peaceful applications of nuclear technology. While the conference is unlikely to make specific recommendations, it will likely discuss some proposals to strengthen the regime, including those from President Bush and the International Atomic Energy Agency (IAEA) Director General Mohamed ElBaradei. Developments in the last 2 years in the nuclear programs of Iran, North Korea, and Libya have been keenly watched Congress, as well as by the rest of the world. Recent congressional actions -- whether resolutions, funding legislation, and nonproliferation sanctions -- have played a role in U.S. nonproliferation policy, and, ultimately, bear on the success of the NPT and the nonproliferation regime. Those actions affect the U.S. record in nuclear disarmament,

progress in diminishing the threat of terrorist access to nuclear weapons, and responses to the noncompliance of countries like Iran, Libya, and North Korea. The May conference may be of relevance to some pending legislation in the 109th Congress. This report will not be updated.

DTIC

Disarmament; Nuclear Weapons; Policies; United States

20080003164 Congressional Budget Office, Washington, DC USA

Costs of Reprocessing versus Directly Disposing of Spent Nuclear Fuel

Orszag, Peter R; Nov 14, 2007; 14 pp.; In English

Report No.(s): AD-A474379; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This testimony presents the Congressional Budget Office's (CBO's) analysis of the costs of two alternatives for the use and disposal of nuclear fuel. For the past 50 years, the nuclear waste produced at reactors across the USA has largely been stored at the reactor sites. That practice, however, has been deemed untenable for the long run. CBO's analysis compares the cost of two fuel-cycle alternatives for the current generation of thermal reactors. One alternative is the 'direct disposal' approach stipulated by current law, which involves using nuclear fuel once, cooling it on site at the reactor, and then disposing of the waste in a long-term repository. The second alternative is the 'reprocessing approach,' in which spent nuclear fuel is cooled on site and then reprocessed for one additional use in a reactor, and the wastes from reprocessing are stored in a long-term repository.

DTIC

Cost Analysis; Costs; Disposal; Nuclear Fuels; Radioactive Wastes; Reclamation; Spent Fuels; Thermal Reactors; Waste Disposal

20080005223 Texas Univ. at Dallas, Richardson, TX USA

Use of L and M Shell Electrons to Trigger Nuclear Spin Isomers

Collins, Carl B; Nov 19, 2007; 13 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0196

Report No.(s): AD-A474483; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474483>

Populations of nuclear spin isomers of $^{178}\text{Hf}m_2$ can be triggered to release their stored energies by the absorption of x-rays having energies in the range 9-13 keV. We have found the basic absorption spectrum for triggering to be approximately 0.16% of the cross section for photoionization of the L-shell electrons surrounding the isomeric nuclei. The maximum effect is induced by X-rays with energies exceeding the threshold for the photoionization of L3 electrons by amounts less than 10 eV. Absorption of a photon of that energy, around 9567 eV triggers the release of 2.446 MeV, thus producing a gain of radiative energy of 256 times for each event. Confidence in the observations of such triggering is better than 10 followed by 1823 zeros to 1.

DTIC

Actuators; Electrons; Isomers; Nuclear Spin

20080005719 Assistant Secretary of Defense (Nuclear and Chemical and Biological Defense Programs), Washington, DC USA

Nuclear Weapon Accident Response Procedures (NARP)

Feb 22, 2005; 343 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474937; DOD 3150.8-M; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This Manual is issued under the authority of DoD Directive 3150.8 and supersedes DoD 3150.8-M, 'Nuclear Weapon Accident Response Procedures (NARP), December 1999 (hereby canceled). This edition of DoD 3150.8-M will serve as a bridging document until a new edition is developed under updated DoD guidance to meet the NRP requirements. This Manual provides a concept of operations as well as functional information necessary to execute a comprehensive and unified response to a nuclear weapon accident. It provides information for planners and response elements to understand the overall response concept and roles the Department of Defense (DoD) and the Department of Energy/National Nuclear Security Administration (DOE/NNSA) assume as both Lead Federal Agency (LFA) and as a coordinating or cooperating agency under the NRP. This Manual assumes that a radiological release has occurred because of a nuclear weapon accident and that consequence management operations are required. This edition of this Manual also provides information on site remediation (SR) activities after an accident. Crisis response operations to respond to a terrorist attack on a U.S. weapon are not addressed in this Manual.

This Manual provides a model response organization reflecting the philosophy and structure used by State and local responders nationwide. It identifies publications and resources used in response efforts, describes the policies and responsibilities outlined in the publications, identifies specific radiological information available in other publications, and provides a basis for developing detailed plans tailored to each Theater of Operations and Response Task Force (RTF) area of operations. This Manual outlines the current policies and planning that set forth the responsibilities and procedures for DoD forces and provides information for the DOE/NNSA when preparing for and responding to a nuclear weapon accident.

DTIC

Accidents; Nuclear Weapons; Responses

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*.

20080003005 Air Force Research Lab., Wright-Patterson AFB, OH USA

Stimulated Photorefractive Backscatter Leading to Six-Wave Mixing and Phase Conjugation in Iron Doped Lithium Niobate (Preprint)

Evans, D R; Saleh, M A; Banerjee, P P; Carns, J; Cook, G; Apr 2007; 25 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474066; AFRL-ML-WP-TP-2007-497; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474066>

Oblique incidence of a 532 nm pump on LiNbO₃:Fe, nominally propagating along the +c axis, produces six waves through two-wave coupling (self diffraction) and four-wave mixing (parametric diffraction). One of these waves, the stimulated photorefractive backscatter, contains the self-phase conjugate. The dynamics of six-wave mixing and their dependence on crystal parameters and angle of incidence are analyzed. A novel order analysis of the interaction equations provides further insight into experimental observations. The quality of the backscatter is evaluated through image restoration, interference experiments, and visibility measurement. Reduction of two-wave coupling may significantly improve the quality of the self-phase conjugate.

DTIC

Backscattering; Doped Crystals; Iron; Lithium Niobates; Phase Conjugation

20080003134 Naval Research Lab., Bay Saint Louis, MS USA

Why Does the Secchi Disk Disappear? An Imaging Perspective

Hou, Weilin; Lee, Zhongping; Weidemann, Alan D; Mar 19, 2007; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A474311; NRL/JA/7330-06-7053; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The widely-used Secchi disk method is re-examined from the modulation transfer aspect. Namely, by assuming a volume scattering function and applying small angle scattering approximation, we show that the Secchi depth and horizontal visibility can be determined using the water modulation transfer function and the corresponding spatial frequencies associated with the disk. A basic equation of Secchi disk is reached that is comparable to the radiative transfer approach, in that the Secchi disk is reached that is inversely proportional to the attenuation coefficient (c). With typical values for parameters applied, we demonstrate that the modulation transfer technique produces a horizontal visibility range of about $4.8/c$, which is inline with previous studies. The improvement lies in the fact that the current approach correctly addresses the response of all spatial frequencies according to the modeled optical transfer function of the water. In terms of Secchi disk theory, the current approach helps to understand the effect of disk size as well as the role of scattering of the Secchi disk depth. The approach presented provides an understanding of Secchi disk disappearance by showing that the disk is moved away from the observer, the spatial frequencies corresponding to the disk size increase, while the modulation transfer dampens contrast at an increased rate.

DTIC

Imaging Techniques; Modulation Transfer Function; Oceans; Transfer Functions; Vision

20080003135 RAC Equipment Trials Wing, RAC Centre, Wareham, UK

Red Phosphorus Jack Grenade

Robinson, C A; Nelson, P A; Bartholomew, P G; Mar 28, 1968; 21 pp.; In English

Report No.(s): AD-A474314; No Copyright; Avail.: Defense Technical Information Center (DTIC)

CDEE PORTON have produced a Red Phosphorus Jack Grenade for AFV local smoke protection, with the object of combining the rapid screening qualities of the No 80 White Phosphorus with the quicker loading and reduced fire hazard of the L5 and L7 Jack Grenades. The Red Phosphorus grenades as tested took even longer to provide an effective screen, 35 seconds, than the 26 seconds for the L7 Grenade. The duration of the screen was better, 87 seconds as opposed to 37 seconds. In other respects it was satisfactory. Its smoke is light grey and is not as noticeable as the White Phosphorus smoke, but is more noticeable than the L7 screen. It is thought that development may overcome the present slowness in the build-up rate of the Red Phosphorus Grenade.

DTIC

Grenades; Phosphorus; Smoke

20080005203 Johns Hopkins Univ., Baltimore, MD, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

OMCat: Catalogue of Serendipitous Sources Detected with the XMM-Newton Optical Monitor

Kuntz, K. D.; Harrus, Ilana; McGlynn, Thomas A.; Mushotsky, Richard F.; Snowden, Steven L.; [2007]; 35 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-26555; NNG06EO90A; NAG5-7584; Copyright; Avail.: CASI: [A03](#), Hardcopy

The Optical Monitor Catalogue of serendipitous sources (OMCat) contains entries for every source detected in the publically available XMM-Newton Optical Monitor (OM) images taken in either the imaging or 'fast' modes. Since the OM records data simultaneously with the X-ray telescopes on XMM-Newton, it typically produces images in one or more near-UV/optical bands for every pointing of the observatory. As of the beginning of 2006, the public archive had covered roughly 0.5% of the sky in 2950 fields. The OMCat is not dominated by sources previously undetected at other wavelengths; the bulk of objects have optical counterparts. However, the OMCat can be used to extend optical or X-ray spectral energy distributions for known objects into the ultraviolet, to study at higher angular resolution objects detected with GALEX, or to find high-Galactic-latitude objects of interest for UV spectroscopy.

Author

Imaging Techniques; Monitors; X Ray Sources; Astronomical Catalogs; XMM-Newton Telescope; Optical Equipment

20080005219 Naval Research Lab., Washington, DC USA

An Evaluation of Compact Laser Drivers for Field-Deployed Analog Fiber-Optic Systems

Diehl, John F; Swingen, Lee A; Devgan, Preetpaul S; Urick, Vincent J; Oct 31, 2007; 13 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474478; NRL/MR/5652--07-9088; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Various laser drivers are analyzed experimentally to determine the impact on the performance of an analog photonic link. For field-deployed units, the NRL-designed supply provides superior noise performance over commercial devices, but the lowest noise is achieved via a bench-top low-noise laser driver.

DTIC

Analog Data; Deployment; Fiber Optics; Laser Outputs; Systems Engineering

20080005588 NASA Glenn Research Center, Cleveland, OH, USA

Single-Shot Rotational Raman Thermometry for Turbulent Flames Using a Low-Resolution Bandwidth Technique

Kojima, Jun; Nguyen, Quang-Viet; Measurement Science and Technology; [2007]; ISSN 0957-0233; Volume 18, pp. 1-9; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 561581.02.08.03.05.01; Copyright; Avail.: Other Sources

An alternative optical thermometry technique that utilizes the low-resolution (order $10(\text{sup } 1) \text{ cm}(\text{sup } -1)$) pure-rotational spontaneous Raman scattering of air is developed to aid single-shot multiscalar measurements in turbulent combustion studies. Temperature measurements are realized by correlating the measured envelope bandwidth of the pure-rotational manifold of the N₂/O₂ spectrum with a theoretical prediction of a species-weighted bandwidth. By coupling this thermometry technique with conventional vibrational Raman scattering for species determination, we demonstrate quantitative spatially resolved, single-shot measurements of the temperature and fuel/oxidizer concentrations in a high-pressure turbulent CH₄ air flame. Our

technique provides not only an effective means of validating other temperature measurement methods, but also serves as a secondary thermometry technique in cases where the anti-Stokes vibrational N₂ Raman signals are too low for a conventional vibrational temperature analysis.

Author

Bandwidth; Raman Spectra; Temperature Measurement; Turbulent Flames; Resolution

20080005691 Texas Univ., Austin, TX USA

Electromagnetic Launch Optical Telemetry Feasibility Study

Snowden, P; Levinson, S J; Oct 2007; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD17-01-D-0001

Report No.(s): AD-A474871; IAT.R-0474; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Results of a preliminary study to evaluate the feasibility of optical telemetry on an EM launched projectile are discussed. At issue are the relative intensities of the optical noise received in the MCL catch tank from the muzzle flash versus the narrowband optical signal levels generated from tiny emitters onboard a projectile after being launched in the MCL.

DTIC

Electromagnetic Radiation; Feasibility; Launching; Optical Properties; Telemetry

20080005696 Naval Research Lab., Washington, DC USA

Results from a Portable Adaptive Optics System on the 1 Meter Telescope at the Naval Observatory Flagstaff Station

Restaino, Sergio R; Gilbreath, G C; Payne, Don M; Baker, J T; Martinez, T; DiVittorio, M; Mozurkewich, David; Friedman, J; Jan 2003; 8 pp.; In English

Report No.(s): AD-A474890; NRL-02-1221.1-3500; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we present results using a compact, portable adaptive optics system. The system was developed as a joint venture between the Naval Research Laboratory, Air Force Research Laboratory, and two small, New Mexico based-businesses. The system has a footprint of 18x24x18 inches and weighs less than 100 lbs. Key hardware design characteristics enable portability, easy mounting, and stable alignment. The system also enables quick calibration procedures, stable performance, and automatic adaptability to various pupil configurations. The system was tested during an engineering run in late July 2002 at the Naval Observatory Flagstaff Station one-meter telescope. Weather prevented extensive testing and the seeing during the run was marginal but a sufficient opportunity was provided for proof-of-concept, initial characterization of closed loop performance, and to start addressing some of the most pressing engineering and scientific issues.

DTIC

Adaptation; Adaptive Optics; Interferometry; Observatories; Telescopes

20080005711 Air Force Research Lab., Wright-Patterson AFB, OH USA

New Phenomena in Dye-Doped Liquid Crystals: Black Hole Effect and Switchable Reversed Diffraction (Preprint)

Evans, D R; Cook, G; Saleh, M A; Carns, J L; Serak, S; Tabiryan, N; Jan 2006; 21 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474923; AFRL-ML-WP-TP-2007-502; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A nonlinear extinction of transmitted light is observed in liquid crystal cells with large concentrations of anthraquinone dye. Two distinct mechanisms are responsible for this effect when exposed to low and high intensity light, respectively. At low intensities, critical opalescence, micro-scatter, and an increase in linear absorption occur; whereas high intensities result in scattering from photo-induced micro-bubbles.

DTIC

Black Holes (Astronomy); Diffraction; Doped Crystals; Dyes; Liquid Crystals; Nonlinear Optics

20080005718 Naval Research Lab., Washington, DC USA

Estimating Optical Turbulence Using the PAMELA Model

Oh, Bun; Ricklin, Jennifer; Eaton, Frank; Gilbreath, CHarmaine; Doss-Hammel, Steve; Moore, Chris; Murphy, James; Oh, Yeonju H; Stell, Mena; Jan 2004; 12 pp.; In English

Report No.(s): AD-A474936; NRL-04-1226-1986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present an optical turbulence model that has evolved from the PAMELA model. After a preliminary report in SPIE 2003 it became apparent that more data was needed to refine this adaptive model. This led us to take twelve months of

over-land data ‘~100 meters pathlength’ at the Chesapeake Bay Detachment of the Naval Research Lab. We present data throughout the year with varying environments with comparison with the model prediction. Our recent modification includes segmenting the windspeed to 3 sections, morning, afternoon, and night for better fitting. This is an attempt to incorporate variable wind speed into the model which is known to contribute significantly to the turbulence in the atmosphere. In addition, we present preliminary results from the over-the-bay data ‘10 km pathlength’

DTIC

Estimating; Optical Equipment; Optical Properties; Turbulence

20080006076 Air Force Research Lab., Wright-Patterson AFB, OH USA

Description of Spherical Aberration and Coma of a Microlens Using Vector Diffraction Theory (Postprint)

Gillen, Glen D; Guha, Shekhar; Sep 2006; 14 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474957; AFRL-ML-WP-TP-2007-519; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474957>

Light distributions of a plane wave refracted by a microlens are calculated using Kirchhoff vector diffraction theory. Numerical results for one and two-dimensional beam profiles and the onset and effects of spherical aberration and coma are investigated for different lens parameters.

DTIC

Aberration; Diffraction; Plane Waves; Vector Analysis

20080006103 Air Force Research Lab., Wright-Patterson AFB, OH USA

Self-Pumped Photorefractive Reflection Gratings in Fe:KNbO₃ (Preprint)

Gook, Gary; Saleh, Mohammad; Evans, Dean R; Aug 2006; 41 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475001; AFRL-ML-WP-TP-2007-535; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475001>

High gain confirmed in off-axis geometries for Fe:KNbO₃ Mismatch between theory and experiment for mid-range crystal angles, especially for the a-c plane* Large apparent variation in the effective trap density with crystal angle* Modified theory gives a good fit to experimental data* Mechanism for trap density anisotropy is uncertain, but may be due to stochastic layering of impurities during crystal growth*, or from the Franz-Keldysh Effect

DTIC

Niobium Compounds; Potassium Compounds

20080006496 NASA Langley Research Center, Hampton, VA, USA

Numerical Solution of Light Scattered from and Transmitted through a Rough Dielectric Surface with Applications to Periodic Roughness and Isolated Structures

Sun, Wenbo; Videnn, Gorden; Lin, Bing; Hu, Yongxiang; [2007]; 33 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 281945.02.13.01.08; Copyright; Avail.: CASI: [A03](#), Hardcopy

Light scattering and transmission by rough surfaces are of considerable interest in a variety of applications including remote sensing and characterization of surfaces. In this work, the finite-difference time domain technique is applied to calculate the scattered and transmitted electromagnetic fields of an infinite periodic rough surface. The elements of Mueller matrix for scattered light are calculated by an integral of the near fields over a significant number of periods of the surface. The normalized Mueller matrix elements of the scattered light and the spatial distribution of the transmitted flux for a monolayer of micron-sized dielectric spheres on a silicon substrate are presented. The numerical results show that the nonzero Mueller matrix elements of the system of the monolayer of dielectric spheres on a silicon substrate have specific maxima at some scattering angles. These maxima may be used in characterization of the feature of the system. For light transmitted through the monolayer of spheres, our results show that the transmitted energy focuses around the ray passing through centers of the spheres. At other locations, the transmitted flux is very small. The technique also may be used to calculate the

perturbance of the electromagnetic field due to the presence of an isolated structure on the substrate.

Author

Light Scattering; Finite Difference Time Domain Method; Surface Roughness; Remote Sensing; Electromagnetic Fields

75

PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20080005812 University of Central Florida, Orlando, FL USA

Surface Plasmon Polariton Dependence on Metal Surface Morphology

Peale, Robert E; Nov 13, 2007; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8718-06-C-0076; Proj-2305

Report No.(s): AD-A474527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Generation and propagation of surface plasmons on nano-structured gold films was studied using optical and electron-beam techniques. Optical excitation of surface plasmons in Au-black films prepared by evaporation in moderate vacuum was observed. Initial indication of propagation of surface plasmons at visible-light frequencies over ~10 nm length scales was observed. A tunable terahertz detector based on two-dimensional plasmons in a semiconductor heterostructure was designed. These results have application to the characterization of the complex permittivity of absorbing films for terahertz bolometers and to the development of a terahertz spectrometer on a chip, both of which are relevant to terahertz remote chemical and biological sensing.

DTIC

Detectors; Electron Beams; Metal Surfaces; Morphology; Plasmons; Polaritons

20080006111 Air Force Research Lab., Wright-Patterson AFB, OH USA

Influence of an Additional Ballast Volume on a Pulsed ICP Discharge (Postprint)

Bogdanov, E A; DeJoseph, Jr , C A; Demidov, V I; Kudryavtsev, A A; Serditov, K Yu; Aug 10, 2007; 8 pp.; In English

Contract(s)/Grant(s): Proj-2301

Report No.(s): AD-A475011; AFRL-PR-WP-TP-2007-241; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475011>

A spatial and temporal numerical simulation has been carried out of a pulsed (100% modulated), rf inductively coupled plasma discharge in argon, connected to an additional (ballast) diffusion chamber of much larger volume. It is demonstrated that during the active phase, the presence of the large ballast volume has a small impact on the parameters of the plasma in the smaller discharge chamber. In this case the plasma parameters in the discharge chamber can be estimated separately from the diffusion chamber by a standard method using the characteristic ambipolar diffusion time (for example, using a global model). However, during the afterglow phase, the situation is changed significantly. In the afterglow, the densities of charged particles in the discharge chamber become lower than in the large ballast chamber due to more rapid diffusion loss. As a result, the reverse of the active phase situation occurs, namely, the plasma does not flow from the small to the large chamber, but in the opposite direction, from diffusive to discharge volume, and both the plasma density gradient and the self-consistent ambipolar electric field in the small chamber change directions.

DTIC

Afterglows; Electromagnetic Pulses

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*.

20080002931 Buckmaster Research, Urbana, IL USA

A Study of Flame Physics and Solid Propellant Rocket Physics

Buckmaster, John; Oct 2007; 12 pp.; In English

Contract(s)/Grant(s): F49620-05-1-0029; Proj-2304

Report No.(s): AD-A473907; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473907>

Topics that have been examined include heterogeneous propellant flame modeling, the construction of 1-dimensional flame models from subgrid 3-dimensional descriptions, aluminum agglomeration, the combustion of heterogeneous propellants containing aluminum, the use of a genetic algorithm to optimally define false-kinetics parameters in propellant combustion modeling, the calculation of fluctuations above a burning propellant and the effect of these fluctuations on the turbulent chamber flow, the 1-dimensional combustion of fine aluminum and ammonium perchlorate in fuel binder, the combustion of model propellant packs of ellipses and ellipsoids, and the packing of pellets relevant to igniter modeling. Other topics are the instabilities of smolder waves, premixed flame instabilities in narrow tubes, and flames supported by a spinning porous plug burner. Much of this work has been reported in the high-quality archival literature such as the *Journal of Fluid Mechanics*, the *Proceedings of the Combustion Institute*.

DTIC

Aluminum; Combustion; Flames; Models; Propellants; Solid Propellant Rocket Engines; Solid Propellants; Solid Rocket Propellants; Turbulent Flow

20080003004 Air Force Research Lab., Wright-Patterson AFB, OH USA

Contra-Directional Two-Beam Coupling for Variable Rear Reflectivities in LiNbO₃:Fe (Preprint)

Evans, Dean R; Cook, Gary; Saleh, Mohammad; Landis, Gerald; Aug 2006; 17 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474065; AFRL-ML-WP-TP-2007-534; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474065>

1. Coating the rear c-surface, we are able to produce a controlled range of rear reflectivity on a photorefractive LiNbO₃ crystal. 2. The contra-directional two-beam coupling does not vary significantly with reduced rear reflection. This agrees with theoretical calculation. 3. The time response of two beam coupling increases with reduced reflectivity. 4. Future work will produce similar work on other types of photorefractive crystals.

DTIC

Coatings; Crystals; Lithium Niobates; Reflectance

20080003101 Explosives Research and Development Establishment, Waltham Abbey, UK

Methods for the Preparation of Initiating and Delay Compositions

Taylor, G W; Nov 1948; 27 pp.; In English

Report No.(s): AD-A474235; ERDE-30/R/48; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available

Crystal Growth; Initiation

20080005253 Academy of Sciences (USSR), Saint Petersburg, Russian Federation

Electric-Field Effects in ESR Spectrum of Low-Spin Center Ni³⁺ in KTaO₃ Crystals (Preprint)

Sochava, L S; Basun, S A; Bursian, V E; Razdobarin, A G; Evans, Dean R; Apr 2007; 7 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A474555; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electric-field effects in ESR spectrum of low-spin ($S=1/2$) tetragonal center Ni³⁺ was studied in KTaO₃ single crystals. Orientation of the centers as well as splitting of the resonance lines was found resulting from the external E-field interaction with the electric dipole moment of the center. The value of the dipole moment was determined to be $p=103D=21.4$ eAngstrom.

An analysis of the experimental results allowed us to make a reasonable choice of microscopic models for two nickel centers in KTaO₃.

DTIC

Crystals; Electric Fields; Electron Paramagnetic Resonance; Nickel

20080005679 Chulalongkorn Univ., Bangkok, Thailand

Basic Research of Self-Organized Quantum Dots and Their Potential In Solar Cells and Novel Devices Applications (Phase 4)

Panyakeow, Somsak; Jan 2006; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0086

Report No.(s): AD-A474850; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This is the research output from our AOARD-supported work on basic investigation of self-assembled quantum dots and their potential applications during 2006. The research project is the fourth year of AOARD-support following the previous ones in 2003 2004 and 2005. During the past year, 6 international journal publications on self-assembled quantum dots and quantum dot molecules, heterostructure solar cells and quantum dot solar cells were published. There were technical papers on different growth techniques for different patterns of quantum dot molecules, e.g. bi-quantum dot molecules, long chain quantum dot molecules, quantum dot rings presented at 14th International Conference on Molecular Beam Epitaxy (MBE 2006), 32nd International Conference on Micro- and Nano- Engineering (MNE 2006), Electronic Material Conference (EMC 2006) and ECTI-CON 2006. Three papers on quantum dot molecule solar cells and their potential applications at high concentrated sunlight were also presented at major international solar cell conferences, i.e. 4th World Conference on Photovoltaic Energy Conversion (WCPEC-4), 21st European PVSEC and at MRS (Material Research Society) Fall Meeting 2006. All our journal and technical papers (17 in total) acknowledge financial supports from AOARD and Thailand Research Fund (TRF). Research work on quantum dot molecules based on InAs and InP materials will be investigated and their applications for high efficiency solar cells will be presented in the upcoming 2nd IEEE-NEMs (Nano/Micro Engineered and Molecular Systems) in 2007. Challenge of 30 % up efficiency quantum dot molecular solar cells will be our target of our research in 2007 and 2008.

DTIC

Quantum Dots; Research; Solar Cells

20080005708 Chulalongkorn Univ., Bangkok, Thailand

Basic Research of Self-Organized Quantum Dots and their Potential In Solar Cells and Novel Device Applications (Phase 3)

Panyakeow, Somsak; Jan 2005; 12 pp.; In English

Contract(s)/Grant(s): FA5209-05-P-0474

Report No.(s): AD-A474920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Aim to achieve a minimum of 30 % conversion efficiency solar cells using Quantum Dot Molecule (QDM) structure QDM. Solar Cells are simpler to fabricate than tandem (Multijunction) solar cells. The QDM solar cells have very high efficiency (60 % in theoretical calculation) solar energy conversion. Achieve QDMs with high dot density (~10¹² cm⁻²), good dot uniformity and dot ordering are needed in this solar cell structure. Achieved 25.9 % non-optimized conversion efficiency QDM solar cell which was reported at WCPEC-4 in Hawaii. Further experiments are needed in order to optimize the number of stacked QDMs, depth of stacking QDM layers, capping materials, anti-reflection coating, fine structure of grid contacts and other parameters which can make us achieve the 30% plus efficiency.

DTIC

Quantum Dots; Research; Solar Cells

20080006114 Air Force Research Lab., Wright-Patterson AFB, OH USA

Transient Gain Enhancement in Photorefractive Crystals with Two Types of Movable Charge Carriers (Preprint)

Shumelyuk, A; Hryhorashchuk, A; Odoulov, S; Evans, D R; Jun 2007; 12 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475015; AFRL-ML-WP-TP-2007-510; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475015>

Considerable improvement of a transient two-beam coupling gain is reported for Sn₂P₂S₆, a photorefractive crystal that

possesses two types of movable charge carriers. A gain enhancement occurs if the phase difference of the interacting beams is abruptly changed to π . It is also achieved with periodic phase variations between two discrete states, zero and π , at modulation frequencies less than the smallest of two reciprocal characteristic times of space charge formation. The direct observation of gain enhancement, which is due to forced deep phase modulation, clarifies the origin of nontrivial dynamics of the coherent oscillation in Sn₂P₂S₆ called ‘optical multivibrator.’

DTIC

Augmentation; Charge Carriers; Crystals

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*.

20080002982 Naval Postgraduate School, Monterey, CA USA

Temperature Stabilization for Negative Bias Temperature Instability

Harbison, Brian K; Sep 2007; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474021; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474021>

Previous research was conducted on a Complementary Metal Oxide Semiconductor (CMOS) to determine the impact of a phenomenon known as Negative Bias Temperature Instability (NBTI). NBTI affects the operational characteristics of these devices, with a stronger effect on p-channel devices. This instability is apparent when the semiconductor is on biased, and exacerbated under thermal stress. This data is useful in determining the projected failure rate of certain submicron technologies. The previous experiment used On-the-Fly techniques at certain temperatures to measure the interface states in order to determine the susceptibility of the device under test to NBTI. In the previous research, thermal stress application was not exact. Temperature drift was observed over long range test evaluations, and subsequent NBTI data was determined unsatisfactory. In order to maintain thermal stress at a constant value during NBTI testing temperature stabilization is necessary. This paper explains the methods explored and adapted to stabilize temperature.

DTIC

Bias; Thermal Instability

20080006314 Air Force Research Lab., Wright-Patterson AFB, OH USA

Negative Thermal Expansion in Ultrathin Plasma Polymerized Films (Postprint)

Singamaneni, Srikanth; LeMieux, Melburne C; Jian, Hao; Bunning, Timothy J; Tsukruk, Vladimir V; Mar 2007; 6 pp.; In English

Contract(s)/Grant(s): FA9550-04-C-0099; F49620-03-C-0069; Proj-4348

Report No.(s): AD-A475201; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Because of the increasing applications of polymer films with nanoscale thickness, it is imperative to fully characterize the physical properties in these films, which could be significantly different from the bulk properties due to the surface and interfacial effects. Interactions with the substrate and high specific surface area (film/air and film/substrate) can cause peculiar properties of the ultrathin polymer films. In a recent study the glass transition of a free standing and supported PS film was found to vary significantly with thickness. Other studies have unveiled several interesting phenomena such as the depth dependent glass transition temperature and thickness dependent thermal expansion. It has been reported that substrate interactions alter the thermal properties of ultrathin poly-(2)-vinylpyridine films. A non monotonic thermal behavior was observed in ultrathin polycarbonate films with a negative and positive thermal expansion below and above glass transition temperature, respectively.

DTIC

Plasmas (Physics); Polymerization; Thermal Expansion; Thickness; Thin Films

ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20080003818 NASA Glenn Research Center, Cleveland, OH, USA

Reshaping NASA's Aeronautics Program

Liang, Anita D.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 59-82; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

We will dedicate ourselves to the mastery and intellectual stewardship of the core competencies of Aeronautics for the Nation in all flight regimes. We will focus our research in areas that are appropriate to NASA's unique capabilities. We will directly address the R&D needs of the Next Generation Air Transportation System (NGATS) in partnership with the member agencies of the Joint Planning and development Office (JPDO).

Derived from text

Air Transportation; Management Planning; NASA Programs; Aeronautics

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*.

20080002969 Naval Postgraduate School, Monterey, CA USA

Attributes of Success in a Challenging Information Processing Environment

Faherty, III, David E; Sep 2007; 71 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473989>

By using graph-theoretic techniques to compare the information processing behaviors of three groups of mid-level working professionals as each undertakes a series of four complex, interdependent, computer-mediated decision-making exercises, this thesis explores 1) the relationship between network centrality and individual performance and 2) the relationship between network density and group performance. The results of this exploration, though mostly inconclusive, call into question both intuition and social network analysis literature. It is predicted that centrality in a network correlates positively with high performance among individuals, but statistical analysis of data collected during controlled experimentation reveal an almost negligible relationship. It is also hypothesized that high density groups outperform low density groups, but density and performance are found to correlate in exactly the opposite direction: as density increases, group performance decreases. As an explanation, this thesis proposes that as network density increases actors require more time to process and respond to incoming information. In as much as central actors possess a greater number of edges (i.e., communication linkages to others), this thesis also argues that centrality in a network has costs, as well as benefits. Further experimentation is needed to test the validity of these conjectures and bring better understanding to Organization Theory, Social Network Analysis, and Information Processing networks.

DTIC

Data Processing; Networks

20080002970 Library of Congress, Washington, DC USA

Journalists' Privilege: Overview of the Law and Legislation in the 109th and 110th Congresses

Cohen, Henry; Ruane, Kathleen A; Oct 18, 2007; 16 pp.; In English

Report No.(s): AD-A473990; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473990>

In *Branzburg v. Hayes*, 408 U.S. 665, 679-680 (1972), the Supreme Court wrote journalists claim that to gather news it is often necessary to agree either not to identify the source of information published or to publish only part of the facts revealed, or both; that if the reporter is nevertheless forced to reveal these confidences to a grand jury the source so identified and other confidential sources of other reporters will be measurably deterred from furnishing publishable information, all to the detriment of the free flow of information protected by the First Amendment. The Court held, nonetheless, that the First Amendment did not provide even a qualified privilege for journalists to refuse to appear and testify before state or federal grand juries. The only situation it mentioned in which the First Amendment would allow a reporter to refuse to testify was

in the case of grand jury investigations ... instituted or conducted other than in good faith.... Official harassment of the press undertaken not for purposes of law enforcement but to disrupt a reporter's relationship with his news sources would have no justification. Though the Supreme Court concluded that the First Amendment does not provide a journalists privilege in grand jury proceedings, 49 states have adopted a journalists privilege in various types of proceedings; 33 have done so by statute, and 16 by court decision. Journalists have no privilege in federal proceedings. On July 6, 2005, a federal district court in Washington, DC, found Judith Miller of the New York Times in contempt of court for refusing to cooperate in a grand jury investigation relating to the leak of the identity of an undercover CIA agent. The court ordered Ms. Miller to serve time in jail. Ms. Miller spent 85 days in jail. She secured her release only after her informant, I. Lewis Libby, gave her permission to reveal his identity.

DTIC

Conferences; Law (Jurisprudence); News Media

20080002972 Naval Postgraduate School, Monterey, CA USA

System of Systems Technology Readiness Assessment

Majumdar, WindyJoy S; Sep 2007; 165 pp.; In English; Original contains color illustrations

Report No.(s): AD-A473994; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA473994>

The Chairman of the Joint Chiefs of Staff established the Joint Capabilities Integration and Development System processes for acquisition of joint capabilities which are achieved through network-centric applications, services, enterprise systems, Family of Systems (FoS) and System of Systems (SoS). In many cases, advanced technologies must be matured simultaneously by multiple systems to support the degree of interoperability and/or integration required. Current DoD guidance with respect to technology development and assessment is focused on a acquisition of a system which operates relatively independently within a collection of other independent systems.

DTIC

Information Systems; Interoperability; Maintainability; Technology Assessment

20080002993 Naval Postgraduate School, Monterey, CA USA

Transforming the Force: A Comparative Analysis of the Department of Defense's (DOD's) Enterprise Resource Planning (ERP) Systems

Hill, Charles W; Sep 2007; 136 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474041; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474041>

Automated Information Systems (AIS) are Software systems that support administrative functions, such as accounting, payroll, finance, personnel, inventory control, logistics, and equipment and maintenance scheduling. An ERP system is a type of AIS that works to integrate all the different functional business areas of an organization. Since the 1990s, a large number of corporations have transitioned from legacy proprietary software to an ERP. The companies who have successfully made the transition have greatly benefited from the flow of information across the organization that is brought about by the ERP's ability to integrate the multi-dimensional data into a single common database. The current AIS environment of the DOD is marked by a lack of systems integration. Like industry, the DOD is looking to combat this environment with ERP systems. This thesis intends to document the history of the ERP implementations in the DOD. In addition, this thesis will highlight the different approaches each service is taking to complete their transitions. The thesis will also compare the plans of the services to the plans that successful corporations executed in their transitions to an ERP. By comparing the plans of the services to industry's guidelines on how to correctly implement an ERP, this thesis will provide new analysis to aid the DOD in this critical endeavor.

DTIC

Automatic Control; Combat; Information Systems; Inventory Controls; Logistics; Support Systems

20080002997 Naval Postgraduate School, Monterey, CA USA

Data Centric Integration and Analysis of Information Technology Architectures

Giammarco, Kristin; Sep 2007; 179 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474052; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474052>

The premise of this thesis is that integrated architectures have increased usefulness to the users of the systems they

describe when they can be interactively and dynamically updated and used in conjunction with systems engineering analyses to enable systems optimization. In order to explore this premise, three research topics are presented. The first topic discusses needs and uses for integrated architectures indicated throughout Department of Defense (DoD) policies, directives, instructions, and guides. The second topic presents a systems engineering analysis process and discusses the relevancy of integrated architectures to these analyses. Building on the previous two topics, the third discusses federation, governance, and net-centric concepts that can be used to significantly improve DoD Enterprise Architecture development, integration, and analysis; with specific recommendations for the Army Architecture Integration Process. A key recommendation is the implementation of a collaborative environment for net-centric architecture integration and analysis to provide a rich and agile data foundation for systems engineering and System of Systems engineering analyses, which are required to optimize the DoD Enterprise Architecture as a whole. Other conclusions, recommendations, and areas for future work are also presented.

DTIC

Data Bases; Data Integration; Information Systems; Systems Engineering; Systems Integration

20080003010 Naval Postgraduate School, Monterey, CA USA

Techniques for Automatically Generating Biographical Summaries from News Articles

Esparza, Matthew W; Sep 2007; 211 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474074; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474074>

The work of manually creating a biographical summary from multiple information sources is both time-intensive and detail-oriented. Automating the task is also non-trivial because of the many natural language processing (NLP) areas that must be used to efficiently extract the relevant facts. Yet, no study has been done to determine how powerful a biographical summarization system must be to achieve the basic goal of filling slots in a biography template. Equally important, the simplest approaches to discovering and extracting biographical information from text have not been implemented. Further, no standard evaluations have been developed for summarization in general, but an evaluation methodology for this research is described and performed.

DTIC

Biography; Data Processing; Extraction; Information Retrieval; Natural Language (Computers)

20080003013 Army Research Lab., Aberdeen Proving Ground, MD USA

Web-Based Programming for Real-Time News Acquisition

Neiderer, Andrew M; Richardson, John; Sep 2007; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-611102H48

Report No.(s): AD-A474080; ARL-MR-671; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474080>

This report describes a Web 2.0 application that was developed at the U.S. Army Research Laboratory in support of its Real-Time News Analysis (RTNA) project. It uses the Google, Inc. AJAX search application programming interface to acquire data and subsequently formats resultant data for analysis. News stories for a specified topic (e.g., terrorist bombing) are gathered from public sources by a function in a JavaScript node of an extensible markup language formatted document (XHTML). Content of selected elements is then extracted, or scraped, from the XHTML. The designed graphical user interface allows one to choose up to 10 words and/or phrases and permits explicit exclusion of certain semantics. Presently, the selected data sources are determined by Google News and user-specified in a Google Web service. A Google gadget for Maps has been added for geographic visualization of location, and additional searchers for Google Video, Blog, and Book have been tested and can be easily added to the search controller. The application also allows for integration of asynchronous JavaScript and XML technology, including Java servlets for requesting data and Java Server Pages for the responses.

DTIC

Data Acquisition; Data Processing; Internets; Real Time Operation

20080003095 MTS Technologies, Inc., Orlando, FL USA

Taking the Mystery out of Information Assurance for the 21st Century Training Community

Kaczor, William; Thornley, Craig; Guynn, Buddy; Jan 2006; 10 pp.; In English

Report No.(s): AD-A474222; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information Assurance 'IA' is one of the most overlooked yet critical aspects of any Information Technology 'IT' system. Although IA applies to every IT system, we will focus on its application to simulators and any IT powered training device

connecting to a DoD network. IA is the overarching process consisting of Computer/Network/Data/Information Security. If IA is built into every training and education system, and maintained throughout its life cycle, it is guaranteed to lower compromising threats to DoD assets. This paper will take the mystery out of IA, system security engineering, and the security Certification and Accreditation 'C&A' process from both government and industry perspectives. It will provide proven solutions to achieve C&A on any system under differing conditions and time frames, and document the process of IA using proven systems security engineering processes, the DoD Information Technology Security Certification and Accreditation Process 'DITSCAP', and the documentation strategy of using the System Security Authorization Agreement 'SSAA' and the System Security Plan 'SSP'. This paper will also provide examples of Information Assurance Vulnerability Alerts 'IAVAs', including how they work and greatly reduce the risk to all IT systems. It will present the best practices for new systems, blended certification approaches, how to certify legacy systems, and the proper end of life disposal. The 21st century force is moving more toward a net-centric, real time, and IT-based integrated operational and training environment. To achieve war-fighting excellence, IA of computer systems and networks should be a major focus of all new system designs for protection of national defense information and assets.

DTIC

Certification; Education; Real Time Operation; Security; Systems Engineering

20080003137 Naval Research Lab., Bay Saint Louis, MS USA

Determining Heterogeneous Bottom Friction Distributions using a Numerical Wave Model

Keen, Timothy R; Rogers, Erick; Dykes, James D; Kaihatu, James M; Aug 11, 2007; 14 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474323; NRL/JA/7320-04-0013; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper describes a method for estimating spatially variable bottom roughness lengths (kb) in friction-dominated coastal regions where dense measurements of the significant wave height are available. The method utilizes a numerical wave model to calculate wavefields. The model-predicted significant wave height is compared to a control simulation with a known kb field, which is a proxy for measured wave heights. The error is used in combination with an influence matrix to successively correct the bottom roughness field. This predictor-corrector calculation is completed in a series of analysis cycles. The method is demonstrated in an idealized basin with different kb distributions. The test cases simulate swell propagating over a sloping beach. The original kb fields are recovered in a reasonable number of analysis cycles but the method is limited by the influence of bottom friction on the wave height. The inversion is shown to be robust in the presence of errors in the measured wavefields as well as random bathymetry errors. However, the inversion fails if bathymetry errors are large and/or systematic because the friction error is not substantially greater than the error from bathymetry, which is also a key parameter for calculating the wave height. Thus it is important to select parameters and variables that have well-defined dependencies in the numerical wave model for this procedure to be effective.

DTIC

Friction; Heterogeneity; Mathematical Models

20080003147 Naval Postgraduate School, Monterey, CA USA

Linking Information for Mobile Use

Myers, Robert N; Zapata, Edwar; Sep 2007; 95 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474344; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Information Management (IM) has been an area of research and discussion for several decades. Studies have been conducted by behavioral and computer scientists on how people organize their information and workspaces in order to come up with efficient ways to store, organize and retrieve information on personal computers. This thesis explores improving a user's ability to manage information on mobile devices. The goal is to make placing information on such devices a more attractive prospect, with an emphasis on retrieval of stored information regardless of the document type. This will result in mobile users having quick access to the right information at the right time while away from the office or home. This thesis describes the challenges inherent in a mobile scenario and the system designed to address those challenges. The system provides visual and navigational features that are not currently available on mobile devices, specifically the ability to view multiple types of items in a single interface. Additionally, the ability to logically link related items as an IM tool is examined.

DTIC

Information Systems; Personnel

20080003150 Naval Postgraduate School, Monterey, CA USA

The Integration of Virtual Public-Private Partnerships into Local Law Enforcement to Achieve Enhanced Intelligence-Led Policing

Simeone, Jr, Matthew J; Sep 2007; 139 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474348; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In light of the recent emergence of fusion centers and centralized intelligence units, and the move to develop intelligence capacity within local law enforcement agencies in the USA, intelligence-led policing (ILP) is well-positioned to be on the nation's law enforcement agenda for the next decade. ILP relies on robust data collection from a wide range of sources to create intelligence products that can influence decision makers, and ultimately, impact the criminal environment. Virtual public-private partnerships (VP3s) offer local law enforcement agencies an effective and efficient way to leverage a vast and resourceful private sector for the purpose of enhancing ILP. A VP3 can exponentially enhance data collection capacity, facilitate the utilization of the private sector as a force multiplier, and provide the means by which local policing agencies can begin to instill a culture of preparedness in the citizens they serve. This thesis includes case studies of three VP3s - Citizen Observer, NYPD Shield, and the Nassau County Security/Police Information Network (SPIN). In addition, virtual communities and social capital are examined with an eye towards the potential impact on crime, homeland security, and ILP. The findings of this thesis form the framework for a VP3-enhanced model of intelligence-led policing.

DTIC

Intelligence; Law (Jurisprudence)

20080003151 Naval Postgraduate School, Monterey, CA USA

Detect and Defeat - The Complexities of Accomplishing the HLS Mission with Existing Intelligence Collection Practices

Robertson, Jeffrey T; Sep 2007; 89 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474349; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Since the tragic events of 11 September 2001, it has been argued that accurate and well-vetted intelligence is critical to securing the Homeland. But over 5 years after the historic day, the goal of creating an 'effective' domestic intelligence platform falls short of meeting desired milestones. The distinct threat of radicalism incubating within smaller communities (i.e., townships, rural communities) in the USA still exists and the lack of intelligence collection efforts at the local level may be fueling this threat. This study focuses on local-level law enforcement intelligence efforts in relation to their contribution to the overall Homeland Security objective. The communities of Tonawanda, NY; Nassau County, NY; Valusia County, FL; and Batavia, NY agreed to participate in the study. A survey of intelligence collection and information dissemination was disseminated to residents in each of the participating communities. The results show that although law enforcement resources of smaller populations are recognized as critical assets in the implementation of Homeland Security, small townships and rural communities still experience shortfalls in available resources and Homeland Security-related training. Many of these deficits revolve around domestic intelligence collection, processing, and dissemination. This research project reviews the shortfalls plaguing intelligence collection and sharing at the local level. In conclusion, the author offers a cost-effective strategy to mitigate identified intelligence discrepancies, and proposes a way of improving information sharing among Homeland Security stakeholders.

DTIC

Data Acquisition; Intelligence; Procedures; Rural Areas; Security

20080003161 Naval Postgraduate School, Monterey, CA USA

Perception Management: A Core IO Capability

Zaman, Khyber; Sep 2007; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474371; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis postulates that in today's media environment, with adversaries skillfully using propaganda to skirt nations' resolve, Perception Management is key to military success and should be an Information Operations (IO) Core Capability. The Kargil conflict of 1999 was a political victory for India, while from the Pakistani perspective it was a successful tactical operation turned into a political-diplomatic setback. Pakistan's tactical successes in Kargil were not translated into strategic gains due to a lack of clarity over policy; hence, no real Perception Management offensive was mounted. On the contrary, India hyped the situation with the West using its media as a key element of Perception Management to win substantial political support. Eventually, Pakistani forces had to withdraw in the face of immense international pressure. The author contends that, because only the Indian disinformation about Kargil was publicized, the real history of the conflict became obscured. It is the

central aim of this thesis to present the Pakistani case regarding the Kargil conflict, and to provide a balanced viewpoint of it through Pakistani eyes.

DTIC

India; IO; News Media; Pakistan; Warfare

20080003187 Naval Postgraduate School, Monterey, CA USA

A Prototype of Multilevel Data Integration in the MYSEA Testbed

Portner, Andrew D; Sep 2007; 101 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474413; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Much of the information managed by government agencies is stored in databases. Mission Assurance objectives often require the synthesis of data from separate databases. Data Integration is used to address this need for combining sets of data. However, because many government organizations store data in databases with different syntactic characteristics and at different classification levels, they will necessarily want to combine data from these divergent data sources. This requires a secure system to ensure that sensitive information is not disclosed to unauthorized parties. The Monterey Security Architecture (MYSEA) is an experimental and extensible distributed Multilevel Secure (MLS) computing. This project set out to determine if a data integration application could be supported by the MYSEA environment. Through research on MLS database architectures, existing data integration technologies, and previous work to implement applications on MYSEA, this project was able to both define a high-level design for data fusion support in MYSEA and develop a proof-of-concept application to demonstrate that support.

DTIC

Data Bases; Data Integration; Multisensor Fusion; Prototypes; Security; Syntax; Test Stands

20080005246 Universitaet der Bundeswehr, Hamburg, Germany

Different Aspects of Research on Standardization

Hesser, Wilfried; Nov 1994; 329 pp.; In English; In German

Report No.(s): AD-A474547; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474547>

This document contains a collection of papers that were presented at the Conference on 'MSTQ' that was held in San Pedro, Costa Rica, at the University of Costa Rica in November 1994. The papers are as follows: 'The Structure of National Standards Institutions and Organizations,' by Jens Kleinemeyer; 'Standardization and Law,' by Roland Hildebrandt; 'Technical Product Documentation in Standardization and Quality Management,' by Jan Radtke; 'Functions of Company Standardization,' by Christoph Klein; 'Economic Benefits of Company Standardization,' by Hendrik Adolphi; 'Parameters of the Variety-Reducing Effect of Standardization,' by Rolf Meyer; and 'Wirtschaftliche Aspekte der betrieblichen Normung,' by Hendrik Adolphi.

DTIC

Economics; Law (Jurisprudence); Organizations; Standardization; Total Quality Management

20080005316 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Style Guide for AFIT Dissertations, Theses, and Graduate Research Papers

May 2007; 103 pp.; In English

Report No.(s): AD-A474581; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Style Guide for AFIT Theses and Dissertations (hereinafter referred to as the AFIT Style Guide) contains guidance for preparing AFIT theses and dissertations. These documents are an important part of the Institute's graduate degree requirements. In this guide you will find detailed information about such topics as the systems of documentation used at AFIT, the formats of graphics and equations to convey technical information, and the formats of AFIT theses and dissertations.

DTIC

Education; Manuals; Research; Theses

20080005323 Air Force Academy, CO USA

The USA Air Force Academy: A Bibliography 2001-2005

White, Elwood L; Jan 2006; 66 pp.; In English

Report No.(s): AD-A474592; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The McDermott Library of the U. S. Air Force Academy is pleased to produce the seventh supplement to the UNITED

STATES AIR FORCE ACADEMY: A BIBLIOGRAPHY 1954-1964. This supplement includes materials published between 1 January 2001 and 31 December 2005. It updates the original bibliography and previous supplements that cover the periods of 1954-1964, 1965-1967, 1968-1971, 1972-1982, 1983-1989, 1990-1995, and 1996-2000. Not included in this bibliography are articles from the local area (i.e. Colorado Springs and Denver) newspapers. In most instances, specific athletic events are not covered. Similarly, most Academy publications are excluded.

DTIC

Armed Forces (United States); Bibliographies; United States

20080005329 Library of Congress, Washington, DC USA

Technology Transfer: Use of Federally Funded Research and Development

Schacht, Wendy H; Jul 19, 2007; 23 pp.; In English

Report No.(s): AD-A474603; CRS-RL33527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The federal government spends approximately one third of its annual research and development budget(1) for intramural R&D to meet mission requirements in over 700 government laboratories (including Federally Funded Research and Development Centers). The technology and expertise generated by this endeavor may have application beyond the immediate goals or intent of federally funded R&D. These applications can result from technology transfer, a process by which technology developed in one organization, in one area, or for one purpose is applied in another organization, in another area, or for another purpose. It is a way for the results of the federal R&D enterprise to be used to meet other national needs, including the economic growth that flows from new commercialization in the private sector; the government's requirements for products and processes to operate effectively and efficiently; and the demand for increased goods and services at the state and local level. Congress has established a system to facilitate the transfer of technology to the private sector and to state and local governments. Despite this, use of federal R&D results has remained restrained, although there has been a significant increase in private sector interest and activities over the past several years. Critics argue that working with the agencies and laboratories continues to be difficult and time-consuming. Proponents of the current effort assert that while the laboratories are open to interested parties, the industrial community is making little effort to use them. At the same time, State governments are increasingly involved in the process. At issue is whether incentives for technology transfer remain necessary, if additional legislative initiatives are needed to encourage increased technology transfer, or if the responsibility to use the available resources now rests with the private sector.

DTIC

Financial Management; Technology Transfer; Technology Utilization

20080005339 Library of Congress, Washington, DC USA

Technology Transfer: Use of Federally Funded Research and Development

Schacht, Wendy H; Apr 24, 2007; 23 pp.; In English

Report No.(s): AD-A474618; CRS-RL33527; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The federal government spends approximately one third of its annual research and development budget(1) for intramural R&D to meet mission requirements in over 700 government laboratories (including Federally Funded Research and Development Centers). The technology and expertise generated by this endeavor may have application beyond the immediate goals or intent of federally funded R&D. These applications can result from technology transfer, a process by which technology developed in one organization, in one area, or for one purpose is applied in another organization, in another area, or for another purpose. It is a way for the results of the federal R&D enterprise to be used to meet other national needs, including the economic growth that flows from new commercialization in the private sector; the government's requirements for products and processes to operate effectively and efficiently; and the demand for increased goods and services at the state and local level. Congress has established a system to facilitate the transfer of technology to the private sector and to state and local governments. Despite this, use of federal R&D results has remained restrained, although there has been a significant increase in private sector interest and activities over the past several years. Critics argue that working with the agencies and laboratories continues to be difficult and time-consuming. Proponents of the current effort assert that while the laboratories are open to interested parties, the industrial community is making little effort to use them. At the same time, State governments are increasingly involved in the process. At issue is whether incentives for technology transfer remain necessary, if additional legislative initiatives are needed to encourage increased technology transfer, or if the responsibility to use the available resources now rests with the private sector.

DTIC

Federal Budgets; Technology Transfer; Technology Utilization

20080005344 Zetetix, Oak Park, CA USA

Knowledge Based Systems (KBS) Verification, Validation, Evaluation, and Testing (VVE&T) Bibliography: Topical Categorization

Harmon, S Y; Gonzalez, A J; Knauf, R; Mar 2003; 127 pp.; In English

Contract(s)/Grant(s): Proj-0476

Report No.(s): AD-A474634; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report contains a topical categorization of the bibliography of the literature about verification, validation, evaluation and test of knowledge-based systems. This bibliography contains 800 entries. This categorization identifies more than 50 different techniques and 69 different tools. The literature discusses 20 different application categories including analytical chemistry, management decision aiding, space, telecommunications, financial, computer configuration, law, medical, laboratory data analysis, product design, manufacturing, speech and text understanding, scheduling, software engineering, mineral exploration, and natural language generation. By far, the most cited application was medical with 153 reference citations. Thirty different specific expert systems were cited in this literature. Eleven different system types were identified including embedded, neural network, control, hybrid and production systems. Of these, production systems were the most cited with 68 explicit references.

DTIC

Bibliographies; Expert Systems; Knowledge Based Systems; Proving

20080005375 Executive Office of the President, Washington, DC USA

Leadership Under Challenge: Information Technology R&D in a Competitive World. An Assessment of the Federal Networking and Information Technology R&D Program

Marburger, John H; Kvamme, E F; Scalise, George; Reed, Daniel A; Aug 2007; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A474709; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The USA is today the global leader in networking and information technology (NIT). That leadership is essential to U.S. economic prosperity, security, and quality of life. This report presents a formal assessment of the Federal Networking and Information Technology R&D (NITRD) Program, beginning with a review of global networking and information technology competitiveness. The NITRD Program is examined in the broader context of U.S. networking and information technology leadership and global competitiveness in order to provide a current picture of the U.S. competitive stance and an evaluation of how well the NITRD Program is positioned to help sustain and strengthen U.S. leadership in these critical technologies. The report highlights the need to revolutionize postsecondary education and advanced training in NIT fields and to rebalance the Federal NIT R&D portfolio to emphasize more large-scale, long-term, multidisciplinary activities and visionary, high-payoff goals. This report is organized into five chapters. Chapter 1 provides broad context by examining America's global leadership and competitive position in NIT as compared to major current and likely future competitor nations. Chapters 2 and 3 focus on central aspects of the U.S. NIT ecosystem: NIT education and training, the structure of the Federal NIT R&D portfolio, and technology transfer. In Chapter 4, the PCAST discusses specific NIT R&D areas that it has identified as priorities. The report concludes in Chapter 5 with an assessment of the mechanisms through which the NITRD Program is implemented.

DTIC

Computer Networks; Computers; Information Systems; Leadership; Policies; Research and Development; United States

20080005617 Tokyo Inst. of Tech., Tokyo, Japan

Chance Discovery with Data Crystallization: Discovering Unobservable Events

Nitta, Katsumi; Nov 19, 2007; 8 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA4869-06-1-0120

Report No.(s): AD-A474758; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474758>

The method of data crystallizing reveals the hidden structure by inserting dummy items corresponding to unobservable, i.e., hidden events, to the given incomplete and ill-structured data on past events. The existence of those hidden events and their location in the environment were visualized as a result of data crystallization. The method was evaluated by applying to 1) the simulated data using the 9/11 terrorist network and 2) test data provided by Dr. Bob Schrag via. It was further applied to two real-business domains: 1) redesigning surface inspection system (SIS), and 2) extracting the essence of flow of

arguments in the negotiation logs for hypothetical two companies with respect to three business proposals.
DTIC

Crystallization; Data Management; Exploration; Information Retrieval

20080005851 Army Center for Health Promotion and Preventive Medicine (Provisional), Aberdeen Proving Ground, MD USA

Development of a Deployment Injury Surveillance System Using Medical Air Evacuation Data

Hauret, K G; Clemmons, N; Jones, B H; Hadley, J; Oct 5, 2007; 46 pp.; In English

Report No.(s): AD-A474881; USACHPPM-TR-12-HF-056S-07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In May 2005, the U.S. Army Center for Health Promotion and Preventive Medicine was tasked by the Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health to develop an injury surveillance system for deployed Army Soldiers. A primary objective was to develop a system capable of identifying types and potentially preventable causes of injuries requiring medical air evacuation. The primary data source for air evacuated injured Soldiers was the U.S. Transportation Command Regulating and Command and Control Evacuation System (TRAC2ES) which included standardized diagnosis codes and a free-text patient history from which details for injury causes could be obtained. TRAC2ES data were linked to data from the Defense Casualty Reporting System (DCIPS) and the Army Safety Management Information System (ASMIS) to obtain additional details for the injury causes and circumstances. Since information on injury causes was in free-text fields, coders reviewed each air evacuation case and applied a standardized coding scheme (STANAG) to classify causes of injury. The final enhanced air evacuation data system included 1) linked data from TRAC2ES, DCIPS and ASMIS and 2) coded causes and types of injuries. This system provided high quality, analysis-ready data and is well suited for deployment injury surveillance.

DTIC

Air Transportation; Casualties; Deployment; Evacuating (Transportation); Information Systems; Injuries; Medical Services; Surveillance

20080006144 Industrial Coll. of the Armed Forces, Washington, DC USA

Information and Communications Technology Industry: Spring 2007 Industry Study

Adamson, William; Bezwada, Raji; Doe, David; Duncan, Jeanette; Govil, Akhil; Harms, Timothy; Jones, Luwanda; Karnes, James; Morales, Felipe; Morrison, John; Jan 2007; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A475100; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475100>

The Information & Communications Technology (ICT) industry provides enabling capability for all major industries. The US ICT industry leads the world but must overcome several near-term challenges if it hopes to retain its global leadership. Some of the key challenges include reforming H1-B visa allocations to maintain a strong US-based IT workforce, monitoring the on-going convergence of telephony, data, and video services, resolving the debate over Internet neutrality, and supporting the full implementation of the National Critical Infrastructure Protection Plan. This research paper suggests roles for the global community, the US government and US business to address these and other concerns. Lastly, a growing industry constituency is fostering a paradigm shift to a Service Oriented Architecture (SOA) which fundamentally alters delivery of ICT capability to end users.

DTIC

Industries; Information Systems; Internets

20080006300 General Accounting Office, Washington, DC USA

DOD SCHOOLS: Additional Reporting Could Improve Accountability for Academic Achievement of Students with Dyslexia

Ashby, Cornelia; Dec 2007; 32 pp.; In English

Report No.(s): AD-A475165; GAO-08-70; No Copyright; Avail.: Defense Technical Information Center (DTIC)

DOD provides both online and classroom-based professional development to teachers who work with students who struggle to read, and it used 2004-to-2006 funds designated for professional development on dyslexia to supplement those efforts. Most of this professional development prepares teachers to assess student literacy and provides them with strategies to teach students who have particular difficulties, such as reading comprehension and fluency. The department offers its staff training online through a professional development program known as Scholastic RED, a series of courses that focuses on

raising reading achievement and improving classroom instruction. In responding to our survey, almost all principals indicated their staff had taken these courses, and more than 80 percent of the principals rated the classes as very useful for such specialized instruction. Also, under a recent initiative, DOD provided its special education teachers and specialists, such as speech therapists, with training on how students develop literacy skills and how to teach reading across all grade levels. According to a survey conducted by DOD, most special education teachers and specialists surveyed said they had completed this training. With the 2004-to-2006 funding designated to support students with dyslexia, DOD purchased additional seats for its Scholastic RED courses, purchased tools to assess students literacy skills, and developed two online courses that include specific modules on dyslexia. The online professional development includes a newly developed course: Fundamentals of Reading K-2 and a course under development for grades 3 to 5. After piloting the K-2 course, it was made available to all teachers in February 2007, and according to our survey results, 29 percent of the schools serving those grades had used it by the end of the school year. The grades 3-to-5 course, according to DOD officials, will be available system wide to all staff in the 2007-08 school year.

DTIC

Reading; Schools; Students

20080006310 General Accounting Office, Washington, DC USA

Military Personnel: DMDC Data on Officers' Commissioning Programs is Insufficiently Reliable and Needs to be Corrected

Stewart, Derek B; Mar 8, 2007; 13 pp.; In English

Report No.(s): AD-A475191; GAO-07-372R; No Copyright; Avail.: Defense Technical Information Center (DTIC)

On January 19, 2007, we issued a report on officer accessions, retention, and foreign language training. The purpose of this report is to bring to your attention reliability issues with DMDC data that we encountered while preparing our report and to provide you with our recommendations to address these issues. We found the information that DMDC provided to us on the number of officers accessed from DOD's various commissioning programs to be insufficiently reliable for use in our January 2007 report. Government auditing standards, which are applicable to all federal agencies including DOD, require that data be valid and reliable when the data are significant to the auditor's findings. More specifically, federal internal control standards require that data control activities, such as edit checks, verification, and reconciliation, be conducted and documented to help provide reasonable assurance that agency objectives are being met. We found discrepancies when we compared the DMDC-provided information on the number of officers accessed from DOD's commissioning programs (the academies, ROTC, and OCS/OTS) to information provided by the services.

DTIC

Data Management; Manpower; Personnel; Reliability

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.

20080003902 National Technology Transfer Center, Wheeling, VA, USA

Spinoff 2007

2007; 173 pp.; In English; See also 20080003903 - 20080003941; Original contains color illustrations

Report No.(s): NASA/NP-2007-10-484-HQ; No Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080003902>

In accordance with congressional mandates cited in the National Aeronautics and Space Act of 1958 and the Technology Utilization Act of 1962, NASA was directed to encourage greater use of the Agency's knowledge by providing a link between the NASA research community and those who might use the research for commercial or industrial products. For more than 40 years, NASA has nurtured partnerships with the private sector to facilitate the transfer of NASA-developed technologies. The benefits of these partnerships have reached throughout the economy and around the globe, as the resulting commercial products contributed to the development of services and technologies in the fields of health and medicine, transportation, public safety, consumer goods, environmental resources, computer technology, and industry. Since 1976, NASA Spinoff has profiled more than 1,500 of the most compelling of these technologies, annually highlighting the best and brightest of partnerships and innovations. Building on this dynamic history, NASA partnerships with the private sector continue to seek

avenues by which technological achievements and innovations gleaned among the stars can be brought down to benefit our lives on Earth. NASA Spinoff highlights the Agency's most significant research and development activities and the successful transfer of NASA technology, showcasing the cutting-edge research being done by the Nation's top technologies and the practical benefits that come back down to Earth in the form of tangible products that make our lives better.

Derived from text

Aerospace Technology Transfer; NASA Programs; Research and Development; Product Development

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*.

20080003862 NASA Johnson Space Center, Houston, TX, USA

Protection of Space Vehicles from Micrometeoroid/Orbital Debris (MMOD) Damages

Barr, Stephanie; May 14, 2007; 1 pp.; In English; International Association for the Advancement of Space Safety Meeting, May 2007, Chicago, IL, USA; Copyright; Avail.: Other Sources; Abstract Only

As the environment that puts space vehicles at risk can never be eliminated, space vehicles must implement protection against the MMOD environment. In general, this protection has been implemented on a risk estimate basis, largely focused on estimates of impactor size and estimated flux. However, there is some uncertainty in applying these methods from data gathered in earth orbit to excursions outside. This paper discusses different past thresholds and processes of the past and suggests additional refinement or methods that could be used for future space endeavors.

Author

Micrometeoroids; Protection; Space Debris; Aerospace Vehicles; Meteoritic Damage

20080003865 NASA Dryden Flight Research Center, Edwards, CA, USA

Space Based Range Demonstration and Certification (SBRDC)

Sakahara, Robert; October 25, 2005; 18 pp.; In English; 1st International Association for the Advancement of Space Safety (IASS), 25-27 Oct. 2005, Nice, France; Original contains color illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy ONLINE: <http://hdl.handle.net/2060/20080003865>

This viewgraph presentation describes the development, utilization and testing of technologies for range safety and range user systems. The contents include: 1) Space Based Range (SBR) Goals and Objectives; 2) Today's USA Range; 3) Future Range; 4) Another Vision for the Future Range; 5) STARS Project Goals; 6) STARS Content; 7) STARS Configuration Flight Demonstrations 1 & 2; 8) Spaceport And Range Technologies STARS Objectives and Results; 9) Spaceport And Range Technologies STARS FD2 Objectives; 10) Range Safety Hardware; 11) Range User Hardware; and 12) Past/Future Flight Demo Plans

Derived from text

Certification; Range Safety; Space Transportation; Technology Utilization

20080005848 Colorado Univ., Colorado Springs, CO USA

Satellite Formation Design for Space Based Radar Applications

Tragesser, Steven; Jul 30, 2007; 49 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA9453-06-M-0213; Proj-2181

Report No.(s): AD-A474903; No Copyright; Avail.: Defense Technical Information Center (DTIC)

There is much interest in relative formations in low Earth orbit for many different applications including distributed aperture systems and communications. Methods have been developed to create relative trajectories that do not fight the natural motion caused by oblateness perturbations. The formulas for these J2 Invariant formations are recast in terms of relative orbit parameters that facilitate formation design. Impulsive maneuver schemes have also been developed for relative trajectories but they do not allow for multiple maneuvers for tight control. In this report, a process is developed to create relative orbits that meet design criteria while also not fighting natural motion. A maneuver scheme is employed that allows for tight control and several maneuvers per orbit. A Monte Carlo simulation is performed to assess the performance of this guidance approach with navigation and control errors.

DTIC

Artificial Satellites; Earth Orbits; Evolution; Natural Satellites; Radar Navigation; Space Based Radar

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20080003195 Naval Observatory, Washington, DC USA

Dense Optical Reference Frames: UCAC and URAT

Zacharias, Norbert; Jan 2007; 7 pp.; In English

Report No.(s): AD-A474435; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A series of ground-based, dedicated astrometric, observational programs have been performed or are in preparation which provide a dense, accurate, optical reference frame. Integral to all these programs are new observations to link the Hipparcos Celestial Reference Frame (HCRF) to the International Celestial Reference Frame (ICRF), based on compact, extragalactic radio sources. The U.S. Naval Observatory CCD Astrograph Catalog (UCAC) 3rd release is in preparation. A pixel re-reduction is in progress to improve astrometric and photometric accuracy as well as completeness of this all-sky reference frame catalog to 16th magnitude. Optical counterparts of ICRF radio sources have been observed with 0.9-meter telescopes contemporaneously. Scanning of over 5000 early-epoch astrograph plates on StarScan has been completed. These data will improve the proper motions of stars in the 10 to 14 mag range for the UCAC3 release. A 111 million-pixel CCD was successfully fabricated in 2006 and test observations at the USNO astrograph are underway. Four of these detectors will be used for the USNO Robotic Astrometric Telescope (URAT) focal plane assembly. Phase I of URAT will use the astrograph to reach 18th magnitude, while the new 0.85-meter telescope with a 4.5 deg diameter field of view will reach 21st magnitude. The URAT primary mirror has been produced.

DTIC

Astrometry; Robotics; Telescopes

20080003337 Air Force Research Lab., Edwards AFB, CA USA

On NEO Threat Mitigation (Preprint)

Cambier, Jean-Luc; Mead, Frank; Oct 15, 2007; 26 pp.; In English

Report No.(s): AD-A474424; AFRL-RZ-ED-TP-2007-440; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is well known that Near-Earth Objects (NEO) and other celestial bodies can be a threat to human existence and civilization. While impacts with large objects occur with very low probability, the consequences can be so catastrophic and irremediable that a program to alleviate this type of threat would seem a very prudent decision. Currently, NASA has been tasked with detecting and characterizing NEOs. However, the role of mitigating these threats is yet to be defined, and may be suitable for USAF responsibility. Mitigation approaches are varied and require further study, but of particular concern are the most difficult scenarios of interception, involving objects with large mass and little advance warning. Although threat mitigation will require important decisions, authorizations, multi-agency coordination and likely international collaboration, some essential long-term planning steps are required to develop and mature key technologies in order to defeat these threats. These steps can be part of an overall long-term strategy for space exploration and utilization that can be part of a global peace-time DOD activity, and that can also greatly increase the welfare of mankind.

DTIC

Asteroids; Celestial Bodies; Comets

20080003843 NASA Marshall Space Flight Center, Huntsville, AL, USA

A Hard X-Ray Telescope Science Enhancement Package for the Constellation X-Ray Mission

Ramsey, Brian; Gorenstein, Paul; October 19, 2007; 8 pp.; In English; Washington University Conference, 19 Oct. 2007, Saint Louis, MO, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Details of a hard-x-ray science enhancement package for the Constellation-X mission are presented. A scientific case is made for the inclusion of such an instrument on the planned mission and a detailed design is presented that will satisfy science requirements yet fall within the ground rules for enhancement packages: a cost of less than \$100M and a mass of no more than 100 kg.

Author

Constellation-X; X Ray Astronomy; Instrument Packages; Fabrication; Augmentation

20080003942 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Coronagraph Workshop 2006

Traub, Wesley A., Editor; July 2007; 172 pp.; In English; Coronagraph Workshop, 28-29 Sep. 2006, Pasadena, CA, USA; See also 20080003943 - 20080003973; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS7-03001; Proj. 101743

Report No.(s): JPL Publ-07-02; Copyright; Avail.: CASI: [A08](#), Hardcopy

ONLINE: <http://hdl.handle.net/2014/40405>

This volume contains the following contributions corresponding to the oral presentations of about 45 authors at the Coronagraph Workshop 2006 held in Pasadena, CA, on 28-29 September 2006: Theoretical Analysis of Coronagraphs; Terrestrial Planet Finder Coronagraph Optical Requirements; A Review of Coronagraph Laboratory Results; Coronagraph Critique; Mirror Technology Assessment; Large Optical Systems Integration, Test and Verification; Science Operations and the Minimum Scale of TPF; TPF-C: Size and Completeness; The Super-Earth Explorer; Achromatic Optical Vortex Coronagraph with Subwavelength Gratings; Japanese Terrestrial Planet Finder; The SPICA Coronagraph Project; The Coronagraphs of MIRI/JWST and SPHERE/VLT as Valuable Experiences for TPF-C; Coronagraphs on the Hubble Space Telescope; Recent Coronagraph Experimental Studies; Status of Development for the AIC and the FQPM; Lyot Project and Gemini Planet Imager; The Near-Infrared Coronagraphic Imager; High Contrast Coronagraphy and Extreme Adaptive Optics Experiments at Palomar; High Contrast Imaging with Focal Plane Wavefront Sensing and PIAA for Subaru Telescope; HiCIAO: High Contrast Instrument for the Subaru Next Generation Adaptive Optics; First Laboratory Demonstration of Anti-Halo Apodization: A Coronagraph 'Afterburner'; Laboratory Demonstrations of High-Contrast Coronagraph Imaging at JPL; Active Thermal Figure Control for Large, Lightweight Honeycomb Mirrors in Vacuum and Space; Thirty Meter Telescope Planet Formation Instrument; Shaped Pupil Coronagraph: State of the Art and Projections for TPF Performance and Readiness; A Nulling Coronagraph for TPF-C; Lyot Coronagraphs with Band-Limited Masks; Optical Vortex Coronagraphy; The Phase-Induced Amplitude Apodization Coronagraph; and New Worlds Observer: An Occulter Based Concept for Terrestrial Planet Finding.

Author

Coronagraphs; Adaptive Optics; Imaging Techniques; Planetary Evolution; Infrared Telescopes; Hubble Space Telescope; Active Control

20080003943 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Nulling Coronagraph for TPF-C

Shao, Michael; Levine, B. Martin; Coronagraph Workshop 2006; July 2007, pp. 135-141; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

This summary outlines a concept study for a high contrast instrument for the Terrestrial Planet Finder Coronagraph (TPF-C) mission. The objectives are to develop a nulling coronagraph based imager and spectrometer concept that will increase the number of planets TPF-C detects, and will expand the wavelength range of the spectrometer into the near-IR to enable detection of additional unique visible biomarkers. This instrument utilizes an alternative starlight suppression system (SSS) based on the principles of nulling interferometry, which allows inner working angles (IWA) within 2-3 λ/D to be obtained, and also to measure low resolution ($R=80$) spectra. Equally important, this concept contains a post starlight suppression wavefront sensor (or calibration wavefront sensor) to increase the achievable contrast level, and to substantially decrease stability requirements during integration. The search for planets will be conducted at short wavelengths, where the IWA is smaller. Extending spectroscopy to 1.7 microns, the visible and near infra-red signatures of likely atmospheric constituents include oxygen, ozone, water, methane, and carbon dioxide, some combinations of which are considered to be biosignatures. Coverage of the 0.5 to approx.1.7 microns wavelength range is done in intervals of 25% bandwidth. Our latest experimental results show null depths using white light that are within an order of magnitude of the required value.

Author

Coronagraphs; Infrared Signatures; Near Infrared Radiation; Terrestrial Planets; Atmospheric Composition

20080003944 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Lyot Coronagraphs with Band-Limited Masks

Kern, Brian; Coronagraph Workshop 2006; July 2007, pp. 142-147; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Band-limited masks in Lyot coronagraphs have received more theoretical and experimental attention than any other coronagraph design under consideration for TPF-C, and 8th-order band-limited masks were the assumed architecture for Flight Baseline 1. The best contrast achieved to date has been with band-limited masks, on JPL's High Contrast Imaging Testbed

(HCIT) (see Trauger, these proceedings). This paper will attempt to illustrate the advantages and disadvantages of band-limited masks, compared to the other potential TPF-C coronagraph architectures; the primary disadvantage is modest throughput and point-spread function (PSF) width, the primary advantages are robustness to aberrations, mechanical simplicity, and maturity. Derived from text

Coronagraphs; Imaging Techniques; Masks; C Band

20080003945 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Shaped Pupil Coronagraph: State of the Art and Projections for TPF Performance and Readiness

Kasdin, N. J.; Belikov, R.; Cady, E.; Carr, M.; Kay, J.; Littman, M.; Pueyo, L.; Vanderbei, R. J.; Trauger, J. T.; Balasubramanian, K.; Echternach, P.; Give'on, A.; Kuhnert, A.; Shaklan, S.; Shi, F.; Neureuther, A. R.; Ceperley, D.; Miller, M.; Shih, T.; Kilston, S.; Lieber, M.; Beall, J.; Coronagraph Workshop 2006; July 2007, pp. 126-134; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

The Shaped Pupil Coronagraph (SPC) is a high-contrast imaging system pioneered at Princeton and designed for the TPF-C telescope. In this document, we summarize the work done to date on the SPC to date and evaluate its current and projected performance. What makes the SPC attractive for TPF is that it is very simple to make and set up, and it is inherently broadband. Owing to the simplicity of the SPC, it is quickly becoming a relatively mature technology with theoretical and experimental validations of its performance. Many shaped pupils have been designed to various specifications and tools are in place to quickly turn out more. Full vector-field simulations show that realistic shaped pupils can already achieve $10(\exp 10)$ contrast in the absence of aberrations. A manufacturing process has been developed to make shaped pupils for as little as a few thousand dollars, at JPL and NIST. Shaped pupils have also been shown to be very insensitive to aberrations, and especially low order aberrations such as tilt and defocus. The SPC is undergoing extensive studies in the lab, and so far a suppression of $4 \times 10(\exp -8)$ has been achieved in 10% broadband light (averaged across a region between 4 and 9 /D), after speckle-nulling-based wavefront correction. The limiting factor is now believed to be well-understood and is primarily the inability of the speckle nulling algorithm to correct for manufacturing errors in the mask. It was shown that this limitation can be overcome by using a more sophisticated estimation algorithm called peak-a-boo, or by using a shaped pupil design that is insensitive to manufacturing defects. The SPC lends itself well to many wavefront estimation and correction schemes. Simulations show that realistic shaped pupil manufacturing errors and realistic wavefront error can be corrected with a single DM at one wavelength, and 2 or 3 DMs in broadband. The main disadvantages of the SPC is throughput, sharpness, and working angle, but the throughput disadvantage may be counterbalanced to an extent by the fact that SPC requires very few optical components and the fact that the light blocked by the mask may still be used to sense aberrations.

Author

Coronagraphs; Optical Equipment; Imaging Techniques; Attitude (Inclination)

20080003946 Northrop Grumman Corp., USA

New Worlds Observer: An Occulter Based Concept for Terrestrial Planet Finding

Arenberg, Jonathan; Lo, Amy; Lillie, Charles; Cash, Webster; Noecker, Charley; Coronagraph Workshop 2006; July 2007, pp. 162-165; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

New Worlds Observer (NWO) is a multi-spacecraft concept that is capable of detecting and characterizing extrasolar planetary systems, as well as obtaining general astrophysics observations. NWO is a rapidly emerging concept only recently introduced into the discussion as a viable concept. This architecture offers an affordable, modest risk option to achieving NASA's long standing goal of identifying and studying Earth-like planets around other stars. The NWO concept consists of an external occulter and a generic space telescope. The occulter has specific requirements on its shape and size, while the telescope is an ordinary diffraction limited astronomical instrument comparable to the Hubble Space Telescope. This system requires a deep space orbit like that for JWST or Spitzer. The occulter is a specially shaped opaque screen (binary mask) that creates a deep shadow in the target star's light, in which the telescope is flown. This deep shadow created by the occulter is the essential element of the New Worlds concept that enables the detection and characterization of extra-solar planets with an ordinary astronomical telescope. Mission concepts to detect extra-solar planets using an external occulter have a long history. What is novel about New Worlds is the combination of deep, broad band starlight suppression ($10(\exp -10)$ over an octave or more), a relatively small occulter, and a manufacturable binary-mask implementation. This leap in starlight suppression, discussed below, enables the design of a practicable mission able to detect and characterize extra-solar terrestrial planets. We briefly review the key factors in the performance of our mission enabling occulter, including our choice of a mask shape, which allows a closed form algebraic analysis⁸ and a numerical evaluation of the diffraction problem. Following this overview of

the occulter's performance and basic scaling laws, we introduce a concept for a mission design. The conclusion lists the ongoing and planned work on New Worlds.

Author

Terrestrial Planets; Planet Detection; Optical Measuring Instruments; Extrasolar Planets; Astrophysics; Occultation; Spaceborne Telescopes

20080003947 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Science Operations and the Minimum Scale of TPF

Brown, Robert A.; Shaklan, Stuart B.; Hunyadi, Sarah L.; Coronagraph Workshop 2006; July 2007, pp. 53-63; In English; See also [20080003942](#); Original contains color illustrations

Contract(s)/Grant(s): JPL-1254081; Copyright; Avail.: CASI: [A03](#), Hardcopy

We have studied the requirements for planetary discovery using TPF. Although the focus has been on TPF-C, the general conclusions apply to TPF-I, as well. Our science-operational concerns do not apply to TPF observing planets found by other means the Space Interferometry Mission (ESA) or ground-based radial-velocity searches, for example. We have found ample indication that the science operations of TPF-I and TPF-C will face significant challenges eliminating background confusion and avoiding wasted observations in the attempt to recover previously discovered planets. In the case of TPF-C, brightness will vary strongly in the detectable portion of the orbit for some planets. In principle, such brightness variations should be helpful for discriminating background sources and gaining orbital information useful for planetary recovery. We expect this phase effect to be more helpful for stars with better resolved habitable zones. Studies in progress should clarify and quantify the benefits. We expect to find a smaller, less helpful phase effect for TPF-I, at least for planets that efficiently redistribute the energy deposited by starlight, by rotation or atmospheric circulation. Adequate astrometric accuracy addresses these challenges. Studies are underway to determine what astrometric accuracy is required to make science operations tolerably efficient and robust against the risks posed by undifferentiated confusion and guesses about recovery based on poor orbital information. These studies will use Monte Carlo methods to model aspects of the issues as well as the mission itself. The results will determine the minimum scale of the TPF mission. Instrument designers are encouraged to study and report the expected astrometric performance of their TPF-I and TPF-C instrument concepts when measuring the star-planet separation and position angle. Modeling similar to that shown here for the discoverable subset, could be performed on the found subset of planets those consistent with the measured apparent separation and brightness of a particular discovered planet. This would more closely emulate the science-operational situation.

Derived from text

Terrestrial Planets; Space Missions; Planet Detection; Astronomy

20080003948 Arizona Univ., AZ, USA

First Laboratory Demonstration of Anti-Halo Apodization: A Coronagraph 'Afterburner'

Codona, Johanan L.; Coronagraph Workshop 2006; July 2007, pp. 108-113; In English; See also [20080003942](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GD28G; Copyright; Avail.: CASI: [A02](#), Hardcopy

A prototype of the AntiHalo Apodization (AHA) system has been implemented and initially demonstrated in the lab. This system uses the diffraction-limited core starlight, normally discarded by the focal plane stop in a coronagraph, to explicitly construct a negative copy of the halo directly in the focal plane. When coherently combined with the coronagraphic halo in the detector plane, the resultant halo is expected to be up to 100x fainter. The total system design includes measuring the complex sum of the halo and the antihalo with an interferometric focal plane wavefront sensor (FPWFS), which is also implemented in the lab. In this progress report, we show initial results from creating the antihalo with a 2-DM Michelson spatial light modulator, and the first modest halo suppression achieved by using an intensity-minimizing search algorithm in the 2-dimensional AHA actuator displacement space. The resulting attenuation of a factor of 6 to 8x, points the way to the expected 2 decades of attenuation when the system is fully functional.

Author

Apodization; Coronagraphs; Halos; Interferometry; Prototypes; Systems Engineering; Afterburning

20080003949 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Laboratory Demonstrations of High-Contrast Coronagraph Imaging at JPL

Trauger, John; Traub, Wesley; Coronagraph Workshop 2006; July 2007, pp. 114-117; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We report the laboratory demonstration of coronagraphic imaging at angular separations and contrast levels that could

permit exoplanet detection at visible wavelengths; hence the existence of at least one viable solution for the physics problem of designing an instrument to detect Earth-like exoplanets, leading ultimately to the design of a TPF-C mission to detect and characterize planetary systems orbiting the nearby stars. The demonstration involves a collaboration of many individuals, including Chris Burrows, Brian Gordon, Brian Kern, John Krist, Andreas Kuhnert, Dwight Moody, Al Niessner, Fang Shi, Dan Wilson, and Marie Levine. Coronagraphs are not new to astronomy, but only recently has the concept been considered for the imaging of Earth-like exoplanets from space. In space, free of the blurring effects of atmospheric turbulence, a coronagraph must further suppress the Airy rings diffracted from the edges of the primary mirror as well as the surrounding field of speckles due to irregularities in the surface figure of the optics. Diffracted light from the mirror edges can be removed by a variety of well-studied coronagraph configurations, each with its specific characteristics and limitations including efficiency, spectral bandwidth, and complexity. Here we demonstrate diffraction suppression with a Lyot-type coronagraph, and speckle suppression with a technique that is applicable to all coronagraph types.

Derived from text

Coronagraphs; Extrasolar Planets; Imaging Techniques; Planet Detection; Image Contrast

20080003950 Liege Univ., Belgium

Achromatic Optical Vortex Coronagraph with Subwavelength Gratings

Mawet, Dimitri; Riaud, Piette; Baudrand, Jacques; Boccaletti, Anthony; Baudoz, Pierre; Rouan, Daniel; Lenaerts, Cedric; Surdej, Jean; Coronagraph Workshop 2006; July 2007, pp. 69-72; In English; See also [20080003942](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We present in this short paper an efficient and powerful solution for making achromatic optical vortex coronagraphs. We propose to use the unique properties of subwavelength grating integrated meta-materials to induce achromatic phase shifts that can be implemented to yield vortices of any topological charge. TPF-C specifications are very challenging and require pushing this concept to its limits.

Author

Coronagraphs; Astrophysics; Telescopes; Elastic Properties; Observatories; Masks

20080003951 Subaru Telescope, Hilo, HI, USA

The Phase-Induced Amplitude Apodization Coronagraph

Guyon, Olivier; Pluzhnik, Eugene; Tanaka, Shinishiro; Gallet, Basile; Colley, Stephen; Vanderbei, Robert; Ridgway, Stephen; Angel, Roger; Woodruff, Robert; Warren, Mark; Coronagraph Workshop 2006; July 2007, pp. 157-161; In English; See also [20080003942](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): JPL-1254445; JPL-1257767; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Phase-Induced Amplitude Apodization Coronagraph (PIAAC) uses lossless amplitude apodization (performed by reflection on aspheric mirrors) to produce a high contrast stellar PSF. It combines nearly 100% throughput with small inner working angle ($< 2 \lambda/D$), preserves the angular resolution of the telescope, is sufficiently robust to stellar angular size and can be designed to have very good achromaticity. The theoretical performance of the PIAAC would enable TPF-C science with a telescope half the size of what would be required if a coronagraph utilizing conventional apodization were used. In this paper, we show how the PIAAC functions and what is its expected performance. We also discuss PIAA optics manufacturing challenges, design trade-offs and results from our ongoing laboratory demonstration.

Author

Coronagraphs; Apodization; Telescopes; Angular Resolution

20080003952 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Optical Vortex Coronagraphy

Palacios, David M.; Swartzlander, G. A., Jr.; Mawet, D.; Coronagraph Workshop 2006; July 2007, pp. 148-156; In English; See also [20080003942](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

Optical Vortex Coronagraphy is a new type of high contrast imaging technique under investigation for the Terrestrial Planet Finder Coronagraph (TPF-C). An optical vortex coronagraph (OVC) replaces the amplitude mask typically found in a Lyot Coronagraph with a spiral etched phase plate called an optical vortex mask (OVM). Ideally an OVC cancels light from a star over the entire pupil. This allows for higher planet light throughput and a tighter inner working angle. In addition, an OVC is relatively insensitive to low-order wave front aberrations of the entrance pupil. Recent experiments have demonstrated the low-contrast application of an OVC. An achromatic OVM for low-contrast applications has also been proposed.⁴ Using a similar technique it may be possible to produce an achromatic OVM suitable for high contrast applications. In this

proceeding, we will address the high contrast performance of an OVC limited by the manufacturability of the OVM. An ideal OVM contains a smoothly varying spiral. However, the spiral phase shape of a real OVM will be pixilated by the lithography technique used to etch it. We simulated this effect with a currently manufacturable non-ideal OVM composed of a grid of square, 0.2 micron x 0.2 micron pixels and present the predicted high contrast performance of an OVC.

Derived from text

Coronagraphs; Imaging Techniques; Terrestrial Planets; Vortices; Etching; Lithography; Masks

20080003953 Princeton Univ., NJ, USA

A Review of Coronagraph Laboratory Results

Kasdin, N. Jeremy; Coronagraph Workshop 2006; July 2007, pp. 29-37; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

This brief paper, and the attached figures, is a summary of a talk given at the 4th International TPF/Darwin Workshop, held on November 8-10, 2006 in Pasadena, CA. The workshop brought together researchers from around the world to discuss progress in developing a joint program for searching for and characterizing exosolar earth-like planets from space. The talk upon which this paper is based summarized the current status of experimental work to develop and test various coronagraph concepts for achieving high contrast in a filled aperture telescope. It is based on work at a myriad of laboratories and the author is indebted to the researchers who generously cooperated and provided the information and images for the paper.

Author

Coronagraphs; Extrasolar Planets; Earth Observations (From Space); Telescopes

20080003954 Observatoire de Paris, France

The Coronagraphs of MIRI/JWST and SPHERE/VLT as Valuable Experiences for TPF-C

Boccaletti, A.; Baudoz, P.; Coronagraph Workshop 2006; July 2007, pp. 78-82; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

This paper presents two projects for which we are developing advanced coronagraphic system based on phase mask coronagraphs.

Author

Coronagraphs; Near Infrared Radiation; Adaptive Optics; Gas Giant Planets; Telescopes; Masks

20080003955 American Museum of Natural History, New York, NY, USA

Lyot Project and Gemini Planet Imager

Soummer, Remi; Oppenheimer, Ben; Macintosh, Bruce, et al.; Coronagraph Workshop 2006; July 2007, pp. 95-96; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

In this communication we briefly present some results obtained with the Lyot Project Coronagraph, and analyze the current performance of this instrument. We present the Gemini Planet Imager (GPI) project which will be on sky in 2010.

Author

Adaptive Optics; Imaging Techniques; Gemini Project; Coronagraphs; Stellar Envelopes; Planetary Evolution

20080003956 National Astronomical Observatory, Japan

Japanese Terrestrial Planet Finder

Tamura, Motohide; Coronagraph Workshop 2006; July 2007, pp. 73-74; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

A Japanese roadmap on direct extrasolar planet studies is presented, from the current ground-based telescope to future IR/Opt space-based telescopes. Several searches for young planets and disks have been conducted with the Subaru 8.2m telescope and its adaptive optics (AO) infrared coronagraph, CIAO. The instrument will be soon upgraded to a new AO and a coronagraph with simultaneous spectral and polarimetric differential imaging modes (HiCIAO), which improve the contrast performance by more than order of magnitudes. A sensitive unbiased survey for extrasolar zodiacal emission around nearby stars is being conducted with the recently launched AKARI space IR telescope (0.7m diameter, 2-200 micron). A successor space IR telescope, SPICA (3.5m diameter, 5-200 micron), is also planned; its high sensitivity will enable the detection and characterization of outer-most planets around nearby stars. For the studies of extrasolar terrestrial planets in Japan (JTTPF), a

high contrast space telescope (HCST; 3.5m, 0.3-2 micron) is under discussion. We are also seeking for collaborations with or joining to foreign missions.

Author

Spaceborne Telescopes; Extrasolar Planets; Coronagraphs; Terrestrial Planets; Imaging Techniques; Adaptive Optics; Gas Giant Planets; Infrared Telescopes

20080003957 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Coronagraph Critique

Noecker, C.; Kasdin, J.; Shaklan, S.; Coronagraph Workshop 2006; July 2007, pp. 38-46; In English; See also [20080003942](#); Copyright; Avail.: CASI: [A02](#), Hardcopy

This short report is a summary of the presentations and discussions at the coronagraph workshop held in Pasadena, CA in September, 2006. The respondents and attendees heard from numerous researchers about the technology and status of various coronagraphic approaches to achieving high contrast imaging very close to the image of a star. We use the term coronagraph here to refer to both internal coronagraphs, those that create high contrast around the image formed by a single telescope (with, of course, the aid of wavefront sensing and control), and external coronagraphs that employ a large occulter to block and diffract starlight before it can enter a distant telescope. This is in contrast to a multiple satellite interferometer such as TPF-I. Our goals in this report are multifold. We not only summarize the presentations and current status of these various concepts, but also place them into the larger context of TPF-C readiness and, to some degree, make comparative assessments. While all agree that it is far too early to make final judgments on readiness and appropriateness of each concept, it is important to highlight our current understanding of the strengths and weaknesses of various designs, both to gain insight on possible TPF-C performance and to allocate resources and directions for current and future research. We also try to give a general picture of technical feasibility and readiness with regard to the basic question of achieving high contrast, in short, do we have an architecture that works? Finally, we lay out the broader questions of performance and readiness for TPF-C to help build a structure for making the important design decisions and to articulate the important open issues that cross all concepts and need to be addressed in the coming few years.

Derived from text

Coronagraphs; Technology Assessment; Telescopes; Imaging Techniques; A Stars; Detection; Occultation

20080003958 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Terrestrial Planet Finder Coronagraph Optical Requirements

Shaklan, Stuart B.; Coronagraph Workshop 2006; July 2007, pp. 19-28; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A02](#), Hardcopy

We discuss the optical requirements for the TPF-C mission. The requirements flowdown begins with science and relies on extensive mission studies to determine the necessary spatial resolution and minimum star-to-planet contrast ratio. This in turn leads to engineering requirements imposed on the system, e.g., mirror shape and stability, pointing control, etc. Our work in this area has led to four important lessons: 1) sequential wave front controllers are preferred because they relax both amplitude uniformity and surface flatness requirements; 2) Uncontrollable high-spatial frequencies look manageable using existing technology; 3) Transmissive masks placed in the image plane have challenging surface power spectral density requirements; and 4) working at 2 or 3 lambda/D is much harder than 4 lambda/D resulting in several important system architecture challenges.

Author

Terrestrial Planets; Coronagraphs; Pointing Control Systems; Controllers; High Frequencies; Shape Control; Masks

20080003959 Subaru Telescope, Hilo, HI, USA

High Contrast Imaging with Focal Plane Wavefront Sensing and PIAA for Subaru Telescope

Guyon, Olivier; Takami, Hideki; Pluzhnik, Eugene; Tanaka, Shinishiro; Gallet, Basile; Colley, Stephen; Tamura, Motohide; Abe, Lyu; Coronagraph Workshop 2006; July 2007, pp. 103-105; In English; See also [20080003942](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): JPL-1254445; JPL-1257767; Copyright; Avail.: CASI: [A01](#), Hardcopy

We describe in this paper the plans for a high contrast imaging system to be deployed on Subaru Telescope. This system makes efficient use of both the new curvature AO systems at Subaru which recently had first light, and the HiCIAO camera, which will be completed in 2007. The proposed system will use 'focal plane wavefront sensing' (FPWFS), a scheme where focal plane images are used to measure the wavefront. It will also use the highly efficient PIAA coronagraph. We show that

these choices will result in a highly efficient high-contrast imaging instrument. Key techniques for this projects are being demonstrated in our high contrast testbed at Subaru Telescope.

Author

Coronagraphs; Infrared Telescopes; Imaging Techniques; Detection; Cameras

20080003960 Arizona Univ., Tucson, AZ, USA

Active Thermal Figure Control for Large, Lightweight Honeycomb Mirrors in Vacuum and Space

Angel, Roger; Kang, Tae; Cuerden, Brian; Coronagraph Workshop 2006; July 2007, pp. 118-121; In English; See also [20080003942](#); Original contains color and black and white illustrations

Contract(s)/Grant(s): NNG05GD28G; Copyright; Avail.: CASI: [A01](#), Hardcopy

Active figure control of lightweight glass honeycomb mirrors will be valuable for making the on-orbit operation of large space optics more precise, lighter, more cost effective, and more thermally stable. Key applications will include very high contrast imaging of extrasolar planets and large scale vacuum test optics, whose optical quality must be controlled for better quality than the space systems under test. The concept presented here relies on the low but finite thermal expansion of honeycomb mirrors made from fused silica, a material commonly used for precision lightweight space optics. The figure is controlled by varying the temperature of the faceplates and individual rib elements. Resistive heating is balanced in a servo control loop against radiative loss to cold fingers inserted in each honeycomb cell. Preliminary finite element models indicate that for a mirror with n cells up to n Zernike modes can be corrected to better than 90% fidelity, with still higher accuracy for the lower modes. An initial demonstration has been made with a honeycomb mirror of borosilicate glass. Interferometric measurements show a single cell influence function with 300 nm stroke and ~5 minute time constant.

Author

Aerospace Systems; Honeycomb Mirrors; Servomechanisms; Vacuum Tests; Borosilicate Glass

20080003961 National Astronomical Observatory, Japan

The SPICA Coronagraph Project

Abe, L.; Enya, K.; Tanaka, S.; Nakagawa, T.; Murakami, N.; Nishikawa, J.; Tamura, M.; Fujita, K.; Itoh, Y.; Katata, H.; Guyon, O.; Coronagraph Workshop 2006; July 2007, pp. 75-77; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We present the latest results of our coronagraphic instrumentation study for the Japanese 3.5m SPICA telescope. Our aim was to validate some of the candidate concepts, amongst which the binary checkerboard mask (Kasdin et al. 2003). This solution benefits from theoretical intrinsic achromaticity, simplicity of its optical implementation which is a key issue since the SPICA telescope is designed to work at cryogenic (4.5K) temperatures. The huge drawback of this solution is its poor so-called inner working angle (IWA) and its overall transmission. This solution, although a clear compromise between performance and complexity, has proven to be a secured backup solution for the SPICA coronagraph.

Author

Coronagraphs; Telescopes; Cryogenic Temperature

20080003962 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Coronagraphs on the Hubble Space Telescope

Krist, John; Coronagraph Workshop 2006; July 2007, pp. 83-85; In English; See also [20080003942](#); Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Hubble Space Telescope (HST) is the most successful high-contrast astronomical imaging instrument that has yet been built (Krist 2004). It has provided numerous images of the scattered light from circumstellar disks and the glow from faint substellar companions. The key to its performance is the stability and high resolution provided by its placement above the atmosphere. Typically, on the ground, high-contrast observations are carried out using coronagraphs that suppress the diffracted light from the central source, some of which remains unsuppressed because of scatter introduced by the uncorrected turbulence of the atmosphere (which exists to some extent, even with adaptive optics, at levels equal to or greater than the scatter created by imperfections in the telescope optics). The residual light is difficult to subtract out because of time-dependent variations in the optics and atmosphere. On Hubble, though, even without a coronagraph, the diffraction pattern and the scattered light from the optics created by a star can be largely subtracted out because the point spread function (PSF) does not vary greatly over time. In some cases, an image of another star taken months after the science observation can be subtracted out, for instance. Such direct (non-coronagraphic) HST observations have been made of many circumstellar disks and jets near stars. Coronagraphs do, however, provide additional performance benefits to HST. Simply by occulting the star,

scatter from optics after the occulter is reduced, as are detector artifacts such as saturated columns and electronic ghosts. With the addition of a Lyot stop, the diffraction pattern of a bright star can be suppressed to below the level of the scattered light from the optics (which cannot be suppressed optically without some sort of wavefront correction such as a deformable mirror). This reduces the effects of PSF instability caused by time-dependent aberration changes and color mismatches between the target and reference star PSFs, as well as reducing photon noise by diminishing the wings of the PSF. HST has three coronagraphs that cover the near-UV to near-IR wavelength range, with varying levels of performance. While none of these coronagraphs could be considered to be anything close to optimal, they have provided high-contrast imaging that has not been matched by ground-based telescopes.

Author

Hubble Space Telescope; Coronagraphs; Optical Measuring Instruments; Light Sources; Imaging Techniques; Diffraction Patterns; Adaptive Optics; Stellar Envelopes

20080003963 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

High Contrast Coronagraphy and Extreme Adaptive Optics Experiments at Palomar

Serabyn, E.; Haguenaer, P.; Mennesson, B.; Wallace, J. K.; Troy, M.; Bloemhof, E. E.; Coronagraph Workshop 2006; July 2007, pp. 100-102; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The next generation of adaptive optics (AO) systems, often referred to as extreme adaptive optics (ExAO), will use higher numbers of actuators to achieve wavefront correction levels better than 100 nm, and so enable a variety of new observations, such as high-contrast coronagraphy. However, the number of potential coronagraph types is increasing, and selection of the most promising coronagraph is subject to many factors. Here it is pointed out that experiments in the ExAO regime can be initiated with existing AO systems, by correcting a subaperture on an existing telescope rather than the full pupil. With a 1.5-m diameter well-corrected subaperture (WCS) on the Palomar Hale telescope, we have recently achieved stellar Strehl ratios as high as 92% to 94% in the infrared, corresponding to wavefront errors of 85,100 nm, and have carried out visible wavelength AO observations. With a WCS, a wide variety of ExAO experiments can thus be carried out immediately, including infrared ExAO imaging and performance optimization, a comparison of coronagraphic approaches in the ExAO regime, and visible wavelength AO.

Author

Adaptive Optics; Coronagraphs; Infrared Imagery; Infrared Radiation

20080003964 National Astronomical Observatory, Japan

HiCIAO: High Contrast Instrument for the Subaru Next Generation Adaptive Optics

Tamura, Motohide; Suzuki, Ryuji; Hodapp, Klaus; Coronagraph Workshop 2006; July 2007, pp. 106-107; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

HiCIAO is a new high-contrast instrument for the Subaru telescope. HiCIAO will be used in conjunction with the new adaptive optics system (188 actuators and/or its laser guide star - AO188/LGSAO188) at the Subaru infrared Nasmyth platform. It is designed as a flexible camera comprising several modules that can be configured into different modes of operation. The main modules are the AO module with its future extreme AO capability, the warm coronagraph module, and the cold infrared camera module. HiCIAO can combine coronagraphic techniques with either polarization or spectral simultaneous differential imaging modes. The basic concept of such differential imaging is to split up the image into two or more images, and then use either different planes of polarization or different spectral filter band-passes to produce a signal that distinguishes faint objects near a bright central object from scattered halo or residual speckles. In order for the Subaru telescope to be at the forefront of the ground-based high contrast science, we are currently developing a higher contrast instrument for the Subaru telescope. We call it HiCIAO ('Hi'gh 'C'ontrast 'I'nstrument for the Subaru Next Generation 'A'daptive 'O'ptics). The HiCIAO camera is designed as a flexible camera that can be configured into different modes of operation in an optical bench environment at the Subaru telescope Nasmyth focus. HiCIAO will be the first instrument which can combine coronagraph with either simultaneous polarization or spectral differential imaging modes (PDI or SDI modes) with minimizing efforts for uncommon path errors. The basic concept of such differential imaging is to split up the image into two or more images, and then use either different planes of polarization, or different spectral filter bandpasses, or both, to produce a signal that distinguishes objects near a star (dust clouds, planets etc.) from scattered light artifacts (residual speckles).

Derived from text

Adaptive Optics; Infrared Telescopes; Laser Guide Stars; Image Contrast; Imaging Techniques

20080003965 Paris Univ., France

The Super-Earth Explorer

Schneider, J.; Riaud, P.; Tinetti, G.; Schmid, H. M.; Stam, D.; Udry, S.; Baudoz, P.; Boccaletti, A.; Grasset, O.; Mawet, D.; Surdej, J.; Coronagraph Workshop 2006; July 2007, pp. 66-68; In English; See also [20080003942](#); Copyright; Avail.:

CASI: [A01](#), Hardcopy

The Super-Earth Explorer Coronagraphic Off Axis Space Telescope (SEE-COAST) is a space mission concept to be submitted to ESA call for proposals. It is devoted to the direct imaging, in the visible, of the stellar light reflected by its planetary companion. Here we present the type of planetary characterization we may accomplish with SEE-COAST, and we include a brief description of the spacecraft and mission strategy.

Author

Coronagraphs; Imaging Techniques; Spaceborne Telescopes; Extrasolar Planets; Atmospheric Physics; Chemical Composition; Thermal Emission

20080003966 ITT Space Systems Div., USA

Mirror Technology Assessment

Matthews, Gary; Coronagraph Workshop 2006; July 2007, pp. 47-50; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

A mirror technology assessment was provided to ground the TPF science community regarding the current state-of-art in space mirror capabilities within ITAR constraints. A generic assessment regarding the various mirror configurations (active vs passive, on-axis vs off-axis, round vs elliptical, coronagraphic quality vs visible quality) was discussed. The maturity level of each of the various concepts was provided in order to help guide future mission planners regarding programmatic risk and the need for early technology development. The fundamental conclusion was that any of the concepts are certainly possible from an engineering standpoint. The major variable was the cost to reduce the risk to an acceptable level such that a robust schedule could be proposed and managed on the program. This assessment and long term program plan in turn would drive the technology development process that would be required prior to baselining the program architecture.

Author

Technology Assessment; Mirrors; Fabrication; Coronagraphs

20080003967 Observatoire de Paris, France

Status of Development for the AIC and the FQPM

Baudoz, P.; Boccaletti, A.; Coronagraph Workshop 2006; July 2007, pp. 90-94; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

This paper presents the development of the Achromatic Interfero-Coronagraph (AIC) and the Four-Quadrant Phase Mask coronagraph (FQPM). Both coronagraphs have been tested in the lab and on ground-based telescope.

Author

Coronagraphs; Adaptive Optics; Astronomy; Planet Detection; Interferometry

20080003968 National Astronomical Observatory, Japan

Recent Coronagraph Experimental Studies

Nishikawa, Jun; Sato, Y.; Muarkami, N.; Baba, N.; Tavrov, Alexander; Yokochi, Kaito; Kurokawa, Takashi; Takeda, Mitsuo; Coronagraph Workshop 2006; July 2007, pp. 86-89; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Some activities on coronagraph experiments in Japan are reported. One is pre-optics for dynamic range absorption with nulling interferometer and deformable mirrors by Nishikawa et al. in NAOJ. Another is polarization differential imaging by Baba et al. in Hokkaido Univ. The third is common-path achromatic interferometer coronagraph by Tavrov et al. in NAOJ and TUAT.

Author

Coronagraphs; Interferometers; Polarization; Adaptive Optics

20080003969 ITT Space Systems Div., USA

Large Optical Systems Integration, Test and Verification

Engerman, Robert; Coronagraph Workshop 2006; July 2007, pp. 51-52; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Fundamentally the process of integration and test of large optical space borne systems is no different than the process

which needs to be used on any space system. Because we are unable to perfectly reproduce space conditions on the ground, we must rely on a combination of techniques to verify and buy-off any space payload before it can be launched. Testing is a significant part of the verification process and deserves critical attention. However, other verification techniques, which per the NASA Systems Engineering Handbook (SP- 610S) include analysis, demonstration, inspection, simulation and records validation are all important methods to be considered. The main point here is that the early design work of any space system should not focus on how the system will be tested prior to flight, but rather how it will be verified prior to flight. Given that large optical systems might be considered by some to be more complicated than many other types of systems (See Figure 1), a disciplined engineering approach must be applied to each subsystem in terms of design and verification. It is especially critical to give attention to the verification plan early on in the design process to reduce technical and programmatic risk. It is certainly preferable to have an end-to-end ground test to demonstrate optical performance of payloads on the ground. However, if the uncertainties in the test and in ground-to-orbit effects are not accommodated by design and/or operationally adjustable parameters (such as focus shift and temperature control), then such a test is meaningless. In other words, it is possible to demonstrate performance on the ground, and then not have the required performance on-orbit

Author

Systems Integration; Aerospace Systems; Payloads; Systems Engineering; Design Analysis; Inspection; Large Space Structures; Ground Tests

20080003970 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

TPF-C: Size and Completeness

Hunyadi, Sarah; Shaklan, Stuart; Brown, Robert; Coronagraph Workshop 2006; July 2007, pp. 64-65; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Terrestrial Planet Finder Coronagraph (TPF-C) is required to find 30 terrestrial planets, provided that each star has such a planet. This requirement may be evaluated using program completeness, the cumulative sum of habitable zone search space observed over the duration of the mission. Beyond meeting mission goals, program completeness is used to compare different types of coronagraph designs. In this study we compare the program completeness of different coronagraph designs: 1) TPF-C FB-1 design, 2) Phase induced amplitude apodization (PIAA), 3) Optical Vortex Coronagraph (Vortex), and 4) New Worlds Observer external occulter (NWO). For all cases we assumed a habitable zone populated with 10,000 Earth-like pseudo planets uniformly distributed in semi-major axis and having an orbital ellipticity in the range [0, 0.1]. The exozodi level was chosen to be equivalent to the mean Solar System zodi level over the entire habisphere. The central wavelength of interest was 550 nm with a bandpass of 110nm. The throughput for the different mask designs is shown in Table 1. The TPF-C FB-1 mission design baseline is an 8x3.5m elliptical primary mirror with a band-limited 8th order occulting mask. An elliptical mirror allows larger habitable zone coverage in one direction, but requires additional rolls and integration time to circularize the inner working angle. The PIAA, Vortex and NWO designs may be able to utilize a 4m telescope, though this is still under study. Therefore, we simulated program completeness with this reduced-size concept. For FB-1, PIAA and Vortex, potential targets were required to be at least 95 degrees from the sun. We also assumed 1 hour of overhead per target to account for slew time between targets. For NWO, we assume a single occulter with the overhead shown in Table 1 and up to 1 full day of integration time per target. We assume that NWO can detect planets at a contrast ratio of 26 magnitudes, while the other designs achieve up to delta magnitude 25.5. We also restricted the potential observable region to a 15 degree latitudinal slew from the previously viewed star. This restriction was combined with an additional constraint on sun-angle that limited the potential targets to be between 45 and 95 degrees from the sun.

Derived from text

Coronagraphs; Terrestrial Planets; Occultation; Apodization; Habitability; Mission Planning

20080003971 Subaru Telescope, Hilo, HI, USA

Theoretical Analysis of Coronagraphs

Guyon, Olivier; Coronagraph Workshop 2006; July 2007, pp. 11-18; In English; See also [20080003942](#); Original contains color and black and white illustrations

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Many high contrast coronagraph concepts have recently been proposed, and many more will likely be developed in the near future. In this paper, I look at the intrinsic performance each concept can theoretically offer (with perfect wavefront, perfect optics). I also show that simple physics sets fundamental limits on the performance of coronagraphs, these limits are quantified and compared to existing designs. This theoretical work provides valuable insight into how to design high performance coronagraphs and explains many of the characteristics of particular designs. This new perspective reveals the importance of stellar angular diameter on coronagraph performance. The simulated observation a sample of target stars reveals

very large performance differences between coronagraph designs considered for exoplanet detection. These performance differences are equivalent to changing the telescope diameter by a factor 2 to 3. This analysis shows that by adopting a high performance coronagraph design, the TPF-C science goals which were previously thought to require an ~8m telescope, could be achieved with a 4m telescope.

Author

Coronagraphs; Planet Detection; Telescopes; A Stars

20080003972 Hawaii Univ., HI, USA

The Near-Infrared Coronagraphic Imager

Ftaclas, Christ; Chun, Mark; Liu, Mike; Toomey, Douglas; Coronagraph Workshop 2006; July 2007, pp. 97-99; In English; See also [20080003942](#); Original contains color illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

The Near Infrared Coronagraphic Imager (NICI) is a facility instrument built for Gemini South by Mauna Kea Infrared, in Hilo Hawaii with an 85-element curvature AO system provided by the Institute for Astronomy (IfA). The PI is Doug Toomey (MKIR), the author is the Project Scientist, and Mark Chun (IfA) has been the lead on the AO system. The dual-channel concept for NICI derives from experience gained at NASAs IRTF with CoCo, where we found that frequent beam switching between target and reference stars and imaging in and out of Methane bands were effective in detecting faint cold objects. The plan for NICI is to use spectral discrimination to detect young gas giant planets by accumulating images in two different spectral channels at the same time.

Author

Near Infrared Radiation; Coronagraphs; Imaging Techniques; Infrared Radiation; Gas Giant Planets; Beam Switching

20080003973 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Thirty Meter Telescope Planet Formation Instrument

Levine, B. Martin; Shao, Michael; Macintosh, Bruce; Coronagraph Workshop 2006; July 2007, pp. 122-125; In English; See also [20080003942](#); Original contains color and black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

Direct detection of extrasolar Jovian planets is a major scientific motivation for the construction of future extremely large telescopes such as the Thirty Meter Telescope (TMT). The instrument must be designed to meet specific scientific needs rather than a simple metric such as maximum Strehl ratio. The Planet Formation Imager (PFI) for TMT is a design for such an instrument. It has four key science missions: The first is the study of newly-formed planets on 5-10 AU scales in regions such as Taurus and Ophiucus, this requires very small inner working distances that are only possible with a 30 m or larger telescope. The second is a robust census of extrasolar giant planets orbiting mature nearby stars. The third is detailed spectral characterization of the brightest extrasolar planets. The final targets are circumstellar dust disks, including Zodiacal light analogs in the inner parts of other solar systems. To achieve these requirements, PFI combines advanced wavefront sensors, high-order MEMS deformable mirrors, a nulling coronagraph optimized for a segmented primary mirror, and an integral field spectrograph.

Derived from text

Planetary Evolution; Coronagraphs; Microelectromechanical Systems; Telescopes; Extrasolar Planets; Stellar Envelopes; Segmented Mirrors

20080005838 Naval Research Lab., Washington, DC USA

Developing a Portable NRL Fast Frame Rate Seeing Monitor

Oh, Bun; Murphy, James L; Baker, Jeffrey T; Gilbreath, G C; Hindsley, Robert B; Mozurkewich, David; Restaino, Sergio R; Fortenberry, Susan L; Jan 2004; 11 pp.; In English

Report No.(s): AD-A474935; NRL-04-1226-1544; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We describe the development of a portable NRL seeing monitor which consists of a 12 inch Meade f/10 telescope with a Dalsa Cad6 260x260 camera having 10 micron pixels. This seeing monitor is capable of up to 700 frames per second. We have three different techniques to measure Fried's r_0 parameter: full aperture, two-hole mask, and two-hole mask with in-line intensifier. For the observations done at the Anderson Mesa, Arizona site in January-July 2004, we present comparison of Fried's r_0 obtained. Calibration, observing techniques, and data analysis techniques are described. Comparison of the three different techniques is discussed.

DTIC

Adaptive Optics; Atmospheric Circulation; Earth Atmosphere; Image Motion Compensation; Portable Equipment

20080006097 Naval Observatory, Flagstaff, AZ USA

Exploring the Variable Sky with the Sloan Digital Sky Survey

Sesar, Branimir; Ivezić, Zeljko; Lupton, Robert H; Juric, Mario; Gunn, James E; Knapp, Gillian R; De Lee, Nathan; Smith, J A; Miknaitis, Gajus; Lin, Huan; Dec 2007; 17 pp.; In English

Report No.(s): AD-A474991; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA474991>

We quantify the variability of faint unresolved optical sources using a catalog based on multiple SDSS imaging observations. The catalog covers SDSS stripe 82, which lies along the celestial equator in the southern Galactic hemisphere ($22^{\text{h}}24^{\text{m}} < \text{J}2000:0 < 04^{\text{h}}08^{\text{m}}$, $1:27 < \text{J}2000:0 < 1:27$, 290 deg^2), and contains 34 million photometric observations in the SDSS ugriz system for 748,084 unresolved sources at high Galactic latitudes ($b < 20$) that were observed at least four times in each of the ugriz bands (with a median of 10 observations obtained over 6 yr). In each photometric bandpass we compute various low-order light-curve statistics, such as rms scatter, 2 per degree of freedom, skewness, and minimum and maximum magnitude, and use them to select and study variable sources. We find that 2% of unresolved optical sources brighter than g 20:5 appear variable at the 0.05 mag level (rms) simultaneously in the g and r bands (at high Galactic latitudes). The majority (2 out of 3) of these variable sources are low-redshift ($z < 2$) quasars, although they represent only 2% of all sources in the adopted flux-limited sample. We find that at least 90% of quasars are variable at the 0.03 mag level (rms) and confirm that variability is as good a method for finding low redshift quasars as the UV excess color selection (at high Galactic latitudes). We analyze the distribution of light-curve skewness for quasars and find that it is centered on zero. We find that about one-fourth of the variable stars are RR Lyrae stars, and that only 0.5% of stars from the main stellar locus are variable at the 0.05 mag level. The distribution of light-curve skewness in the $g - r$ versus $u - g$ color-color diagram on the main stellar locus is found to be bimodal (with one mode consistent with Algol-like behavior).

DTIC

Sky; Sky Surveys (Astronomy)

20080006117 Naval Observatory, Washington, DC USA

Extragalactic Optical-Radio Link Research at USNO

Zacharias, N; Zacharias, M I; Boboltz, D; Fey, A; Gaume, R; Hennessy, G S; Johnston, K J; Ojha, R; Jan 2007; 7 pp.; In English

Report No.(s): AD-A475018; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475018>

Over 500 counterparts of International Celestial Reference Frame (ICRF) sources were observed during 24 deep CCD observing runs as part of the USNO CCD Astrograph Catalog (UCAC) project, providing a direct link to Tycho-2 stars. For some sources a positional accuracy of 10 mas is achieved. A sample of 12 extragalactic ICRF sources are being observed at the Naval Observatory Flagstaff Station's (NOFS) 1.55-meter telescope over several years to monitor optical position stability. First, high resolution imaging of selected sources is obtained at the Lick 3-meter Adaptive Optics system to correlate source structure with optical-radio centroid offsets. As part of the Space Interferometry Mission (ESA), preparatory science about 240 bright QSO's are monitored for photometric variability in B,V,R and I. The USNO Robotic Astrometric Telescope (URAT) will be able to combine deep CCD imaging of all ICRF2 target areas and millions of compact galaxies with a stellar, astrometric, all-sky survey of multiple epochs.

DTIC

Adaptive Optics; Astrometry; Images; Photometry; Stability

20080006316 Naval Observatory, Washington, DC USA

On the Spectral Evolution of Cool, Helium-Atmosphere White Dwarfs: Detailed Spectroscopic and Photometric Analysis of DZ Stars

Dufour, P; Bergeron, P; Liebert, James; Harris, H C; Knapp, G R; Anderson, S F; Hall, Patrick B; Strauss, Michael A; Collinge, Matthew J; Edwards, Matt C; Jul 10, 2007; 19 pp.; In English

Report No.(s): AD-A475208; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We present a detailed analysis of a large spectroscopic and photometric sample of DZ white dwarfs based on our latest model atmosphere calculations. We revise the atmospheric parameters of the trigonometric parallax sample of Bergeron, Leggett, & Ruiz (12 stars) and analyze 147 new DZ white dwarfs discovered in the SDSS. The inclusion of metals and hydrogen in our model atmosphere calculations leads to different atmospheric parameters than those derived from pure helium models. Calcium abundances are found in the range from $\log(\text{Ca}/\text{He}) = -12$ to -8 . We also find that fits of the coolest objects show peculiarities, suggesting that our physical models may not correctly describe the conditions of high atmospheric pressure

encountered in the coolest DZ stars. We find that the mean mass of the 11 DZ stars with trigonometric parallaxes is significantly lower than that obtained from pure helium models and in much better agreement with the mean mass of other types of white dwarfs. We determine hydrogen abundances for 27% of the DZ stars in our sample, while only upper limits are obtained for objects with low-S/N spectroscopic data. We confirm with a high level of confidence that the accretion rate of hydrogen is at least 2 orders of magnitude smaller than that of metals (and up to 5 in some cases) to be compatible with the observations. We find a correlation between the hydrogen abundance and the effective temperature, suggesting for the first time empirical evidence of a lower temperature boundary for the hydrogen screening mechanism. Finally, we speculate on the possibility that the DZA white dwarfs could be the result of the convective mixing of thin hydrogen rich atmospheres with the underlying helium convection zone.

DTIC

Dwarf Stars; Emittance; Helium; Photometry; Spectra; Spectroscopic Analysis; Spectroscopy; White Dwarf Stars

20080006340 Naval Observatory, Washington, DC USA

New Ultracool and Halo White Dwarf Candidates in SDSS Stripe 82

Vidrih, S; Bramich, D M; Hewett, P C; Evans, N W; Gilmore, G; Hodgkin, S; Smith, M; Wyrzykowski, L; Belokurov, V; Fellhauer, M; Jan 2007; 12 pp.; In English

Report No.(s): AD-A475267; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A 2.5 100 region along the celestial equator (Stripe 82) has been imaged repeatedly from 1998 to 2005 by the Sloan Digital Sky Survey (SDSS). A new catalogue of ~4 million light-motion curves, together with over 200 derived statistical quantities, for objects in Stripe 82 brighter than $r \sim 21.5$ has been constructed by combining these data by Bramich, et al. This catalogue is at present the deepest catalogue of its kind. Extracting ~130,000 objects with highest signal-to-noise ratio proper motions, we build a reduced proper motion diagram to illustrate the scientific promise of the catalogue. In this diagram, disc and halo sub-dwarfs are well-separated from the cool white dwarf sequence. Our sample of 1049 cool white dwarf candidates includes at least eight and possibly 21 new ultracool H-rich white dwarfs ($T_{\text{eff}} < 4000$ K) and one new ultracool He-rich white dwarf candidate identified from their SDSS optical and UKIDSS infrared photometry. At least 10 new halo white dwarfs are also identified from their kinematics.

DTIC

Dwarf Stars; Halos; White Dwarf Stars

90

ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20080003133 Air Force Research Lab., Hanscom AFB, MA USA

Interhourly Variability Index of Geomagnetic Activity and Its Use in Deriving the Long-Term Variation of Solar Wind Speed

Svalgaard, Leif; Cliver, Edward W; Oct 31, 2007; 33 pp.; In English

Contract(s)/Grant(s): Proj-1010

Report No.(s): AD-A474310; AFRL-RV-HA-TR-2007-1115; No Copyright; Avail.: Defense Technical Information Center (DTIC)

[1] We describe the detailed derivation of the interhourly variability (IHV) index of geomagnetic activity. The IHV index for a given geomagnetic element is mechanically derived from hourly values or means as the sum of the unsigned differences between adjacent hours over a 7-hour interval centered on local midnight. The index is derived separately for stations in both hemispheres within six longitude sectors spanning the Earth using only local night hours. It is intended as a long-term index and available data allows derivation of the index back well into the 19th century. On a time scale of a 27-day Bartels rotation, averages for stations with corrected geomagnetic latitude less than 55 degrees, are strongly correlated with midlatitude range indices ($R_2 = 0.96$ for the am index since 1959; $R = 0.95$ for the aa index since 1980). We find that observed yearly averages of aa before the year 1957 are ~3 nT too small compared to values calculated from IHV using the regression constants based on 1980-2004. We interpret this discrepancy as an indication that the calibration of the aa index is in error before 1957. There is no systematic discrepancy between observed and similarly calculated ap values back to 1932. Bartels rotation averages of IHV are also strongly correlated with solar wind parameters ($R_2 = 0.79$ with RV2).

DTIC

Geomagnetism; Solar Wind; Variability; Wind Velocity

20080003839 Lawrence Livermore National Lab., Livermore, CA USA

Dust That's Worth Keeping

Hazi, A.; Jan. 26, 2006; 5 pp.; In English

Report No.(s): DE2006-893993; UCRL-TR-218442; Copyright; Avail.: Other Sources

Images taken of interstellar space often display a colorful canvas of portions of the electromagnetic spectrum. Dispersed throughout the images are interstellar clouds of dust and gas--remnants ejected from stars and supernovae over billions and billions of years. For more than 40 years, astronomers have observed that interstellar dust exhibits a consistent effect at a spectral wavelength of 2,175 angstroms, the equivalent of 5.7 electronvolts in energy on the electromagnetic spectrum. At this wavelength, light from stars is absorbed by dust in the interstellar medium, blocking the stars light from reaching Earth. The 2,175-angstrom feature, which looks like a bump on spectra, is the strongest ultraviolet-visible light spectral signature of interstellar dust and is visible along nearly every observational line of sight. Scientists have sought to solve the mystery of what causes the 2,175-angstrom feature by reproducing the effect in the laboratory. They speculated a number of possibilities, including fullerenes (buckyballs), nanodiamonds, and even interstellar organisms. However, none of these materials fits the data for the unique spectral feature. Limitations in the energy and spatial resolution achievable with electron microscopes and ion microprobes--the two main instruments used to study samples of dust--have also prevented scientists from finding the answer. A collaborative effort led by Livermore physicist John Bradley and funded by the National Aeronautics and Space Administration (NASA) has used a new-generation transmission electron microscope (TEM) and nanoscale ion microprobe to unlock the mystery. The Livermore group includes physicists Zu Rong Dai, Ian Hutcheon, Peter Weber, and Sasa Bajt and postdoctoral researchers Hope Ishii, Giles Graham, and Julie Smith. They collaborated with the University of California at Davis (UCD), Lawrence Berkeley National Laboratory, Washington University's Laboratory for Space Sciences in St. Louis, and NASA's Ames Research Center for their discovery. The team analyzed micrometer-size interplanetary dust particles (IDPs), each about one-tenth the diameter of a human hair. Within the particles, they found carriers of the 2,175-angstrom feature: organic carbon mixed with amorphous silicates (glass with embedded metals and sulfides, GEMS), two of the most common materials in interstellar space. Ishii says, 'Organic carbon and amorphous silicates are abundant in interstellar dust clouds, and abundant carriers are needed to account for the frequent astronomical observation of the 2,175-angstrom feature. It makes sense that this ubiquitous feature would come from common materials in interstellar space'. The group's results increase scientific understanding of the starting materials for the formation of the Sun, solar system, and life on Earth.

Derived from text

Cosmic Dust; Interstellar Gas; Transmission Electron Microscopy

20080006115 Washington Univ., Seattle, WA USA

Exploring the Local Milky Way: M Dwarfs as Tracers of Galactic Populations

Bochanski, John J; Munn, Jeffrey A; Hawley, Suzanne L; West, Andrew A; Covey, Kevin R; Schneider, Donald P; Dec 2007; 13 pp.; In English

Report No.(s): AD-A475016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: <http://hdl.handle.net/100.2/ADA475016>

We have assembled a spectroscopic sample of low-mass dwarfs observed as part of the Sloan Digital Sky Survey along one Galactic sight line, designed to investigate the observable properties of the thin and thick disks. This sample of ~7400 K and M stars also has measured ugriz photometry, proper motions, and radial velocities. We compute UVW space-motion distributions, and investigate their structure with respect to vertical distance from the Galactic plane. We place constraints on the velocity dispersions of the thin and thick disks, using two-component Gaussian fits. We also compare these kinematic distributions to a leading Galactic model. Finally, we investigate other possible observable differences between the thin and thick disks, such as color, active fraction, and metallicity.

DTIC

Dwarf Stars; Galaxies; M Stars; Milky Way Galaxy; Populations; Spectroscopy

20080006303 Naval Observatory, Washington, DC USA

Recent Improvements in IERS Rapid Service/Prediction Center Products

Stamatakos, N; Luzum, B; Wooden, W; Jan 2007; 5 pp.; In English

Report No.(s): AD-A475168; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The International Earth Rotation and Reference System Service (IERS) Rapid Service/Prediction Center (RS/PC) at USNO has made several improvements to its combination and prediction products. These improvements are due to the

inclusion of new input data sources as well as modifications to the combination and prediction algorithms. These changes and their impact on the users of the RS/PC data are presented.

DTIC

Data Transmission; Earth Movements; Earth Rotation; Multisensor Fusion; Polar Wandering (Geology)

20080006312 Air Force Research Lab., Wright-Patterson AFB, OH USA

Combined Nonlinear Effects in Two-Photon Absorption Chromophores at High Intensities (Postprint)

Sutherland, Richard L; McLean, Daniel G; Brant, Mark C; Rogers, Joy E; Fleitz, Paul A; Urbas, Augustine M; Aug 2006; 18 pp.; In English

Contract(s)/Grant(s): Proj-4348

Report No.(s): AD-A475196; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Large two-photon and excited state absorption have been reported in donor-acceptor-substituted π -conjugated molecules. We have performed detailed nonlinear absorption and photophysical measurements on a system of AFX chromophores and calculate the nonlinear transmission based on an effective three-level model. A numerical model that includes far wing linear absorption has been developed and compared with an analytical three-photon absorption model. The models are in accordance and yield excellent agreement with experimental nonlinear transmission data for 0.02-M AFX solutions up to laser intensities ~ 1 -5 GW/sq cm. We have extended our modeling efforts to include some new effects that may be anticipated in this regime, such as stimulated scattering, molecular interactions, and saturation. Effects of chirped pulses and linewidth of the pump laser on stimulated scattering are included. Self-focusing and de-focusing are also considered. We report on our experimental observations of various materials and discuss results with respect to our extended theoretical models.

DTIC

Chromophores; Nonlinearity; Photons

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*.

20060042018

Long-wavelength Radar Studies of the Lunar Maria

Campbell, Bruce A.; Hawke, B. Ray; Thompson, Thomas W.; Journal of Geophysical Research (JGR -- Planets); January 1, 1995; In English; Copyright; Avail.: Other Sources

ONLINE: <http://hdl.handle.net/2014/31623>

Radar measurements at 70 cm and 7.5 m wavelengths provide insight into the structure and chemical properties of the upper 5-100 m of the lunar regolith and crust. Past work has identified a number of anomalous regions and changes in echo strength, some attributed to differences in titanium content. There has been little opportunity, however, to compare calibrated long-wavelength backscatter among different units or to theoretical model results. We combine recent high-resolution (3-5 km) 70-cm radar data for the nearside with earlier calibrated full-disk observations to provide a reasonable estimate of the true lunar backscatter coefficient. These data are tested against models for quasi-specular scattering from the surface, echoes from a buried substrate, and Mie scattering from surface and buried rocks. We find that 70 cm echoes likely arise from Mie scattering by distributed rocks within the soil, consistent with earlier hypotheses. Returns from a buried substrate would provide a plausible fit to the observations only if the regolith depth were ~ 3 m or less and varied little across the maria. Depolarized echoes are due to some combination of single and multiple scattering events, but it appears that single scattering alone could account for the observed echo power, based on comparisons with terrestrial rocky surfaces. Backscatter strength from the regolith is most strongly affected by the loss tangent, whose variation with mineral content is still poorly defined. We compared the backscatter values for the mare deposits to the oxide contents inferred from spectral ratio methods, and found that in general the unit boundaries evident in radar images closely follow those seen in color difference images. The 70-cm data are not well correlated with TiO₂ values found using the Charette relationship nor with Fe abundances derived from Clementine observations. The lack of a relationship between radar echo and Fe content is reasonable given the distribution of iron among various mineral phases, but ilmenite content (FeTiO₃) has typically been cited as the dominant cause of changes in loss tangent (and thus the radar absorption). The lack of correlation between the radar data and TiO₂ estimates may arise from uncertainties in the Charette technique, subtle differences in the upper surface and bulk properties of the regolith, mineralogic effects on the radar not linked to titanium content, or to some combination of these factors. Dark crater haloes

in the mare and highlands, and low radar returns from apparent cryptomare regions, are used to illustrate the role radar data can play in identifying changes in regolith composition; low-return haloes around craters such as Petavius may indicate 5-25% contamination of the highlands soil by excavated mare material or a layer of rock-poor ejecta at least several meters deep. The 7.5-m data were shown to correlate to a reasonable degree with estimates of Fe abundance, suggesting that this component of the mare basalts is primarily responsible for attenuation losses at very long wavelengths. The different sensitivities of the two radar wavelengths and multispectral data offers the potential for future deep mapping of the mare lava flows and regolith.

Author

Backscattering; Basalt; Chemical Properties; Clementine Spacecraft; Contamination; Craters; Crusts; Deposits; Ejecta; Fluid Flow; Halos; High Resolution; Highlands; Ilmenite; Iron; Lava; Lunar Maria; Lunar Rocks; Maria; Mie Scattering; Minerals; Oxides; Radar Data; Radar Echoes; Radar Imagery; Radar Measurement; Regolith; Rocks; Scattering; Scattering Coefficients; Soils; Spectral Methods; Surface Properties; Titanium Oxides

20080003788 NASA Marshall Space Flight Center, Huntsville, AL, USA; NASA Marshall Space Flight Center, Huntsville, AL, USA

The Morphology of the X-ray Emission above 2 keV from Jupiter's Aurorae

Elsner, R.; Branduardi-Raymont, G.; Galand, M.; Grodent, D.; Gladstone, G. R.; Waite, J. H.; Cravens, T.; Ford, P.; October 23, 2007; 11 pp.; In English; Eight Years of Science with Chandra Symposium, 23-25 Oct. 2007, Huntsville, AL, USA; Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

The discovery in XMM-Newton X-ray data of X-ray emission above 2 keV from Jupiter's aurorae has led us to reexamine the Chandra ACIS-S observations taken in Feb 2003. Chandra's superior spatial resolution has revealed that the auroral X-rays with $E > 2$ keV are emitted from the periphery of the region emitting those with $E < 1$ keV. We are presently exploring the relationship of this morphology to that of the FUV emission from the main auroral oval and the polar cap. The low energy emission has previously been established as due to charge exchange between energetic precipitating ions of oxygen and either sulfur or carbon. It seems likely to us that the higher energy emission is due to precipitation of energetic electrons, possibly the same population of electrons responsible for the FUV emission. We discuss our analysis and interpretation.

Author

Auroras; Jupiter (Planet); Morphology; X Rays

20080003789 NASA Marshall Space Flight Center, Huntsville, AL, USA

Application of Vacuum Swing Adsorption for Carbon Dioxide and Water Vapor Removal from Manned Spacecraft Atmospheres

Knox, J.; Howard, D.; October 04, 2007; 2 pp.; In English; COMSOL Conference 2007 (COMSOL, Inc.), 4-6 Oct. 2007, Newton, MA, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A01](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080003789>

In NASA's Vision for Space Exploration (Bush, 2004), (Griffin, 2007), humans will once again travel beyond the confines of earth's gravity, this time to remain there for extended periods. These forays will place unprecedented demands on launch systems. They must not only blast out of earth's gravity well as during the Apollo moon missions, but also liftoff the supplies needed to sustain a larger crew over much longer periods. Thus all spacecraft systems, including those for the separation of metabolic carbon dioxide and water from a crewed vehicle, must be minimized with respect to mass, power, and volume. Emphasis is also placed on system robustness both to minimize replacement parts and ensure crew safety when a quick return to earth is not possible. For short-term phases of manned space exploration, such as transit from the earth to the moon, venting of metabolic carbon dioxide and water to space is more efficient than the inclusion of large recycling systems on the spacecraft. The baseline system for the Orion spacecraft is an amine-based vacuum swing system (Smith, Perry et al., 2006). As part of the development of an alternative approach, a sorbent-based CO₂ and H₂O removal system (Knox, Adams et al., 2006), subscale testing was conducted to evaluate potential performance improvements obtainable by recuperating the heat of adsorption to aid in vacuum desorption. This bed design is shown in Figure 1, is depicted here with a lattice structure instead of reticulated foam for heat transfer. The slot widths are approximately 1.2 mm wide and 8.5 mm long. Bed depth is approximately 4.7 mm. Headers (not shown) were produced by the stereo lithography apparatus at MSFC.

Author

Adsorption; Carbon Dioxide; Vacuum Systems; Water Vapor; Manned Spacecraft

20080003790 NASA Marshall Space Flight Center, Huntsville, AL, USA

Observations of a Newly 'Captured' Magnetosheath Field Line: Evidence for 'Double Reconnection'

Chandler, Michael O.; Avakov, Levon A.; Craven, Paul D.; Mozer, Forrest S.; Moore, Thomas E.; October 24, 2007; 20 pp.;

In English; Polar Science Workshop, 24-25 Oct. 2007, Greenbelt, MD, USA; Original contains black and white illustrations; No Copyright; Avail.: CASI: [A03](#), Hardcopy
ONLINE: <http://hdl.handle.net/2060/20080003790>

We have begun an investigation of the nature of the low-latitude boundary layer in the mid-altitude cusp region using data from the Polar spacecraft. This region has been routinely sampled for about three months each year for the periods 1999-2001 and 2004-2006. The low-to-mid-energy ion instruments frequently observed dense, magnetosheath-like plasma deep (in terms of distance from the magnetopause and in invariant latitude) in the magnetosphere. One such case, taken during a period of northward interplanetary magnetic field (IMF), shows magnetosheath ions within the magnetosphere with velocity distributions resulting from two separate merging sites along the same field lines. Cold ionospheric ions were also observed counterstreaming along the field lines, evidence that these field lines were closed. These results are consistent with the hypothesis that double merging can produce closed field lines populated by solar wind plasma. Through the use of individual cases such as this and statistical studies of a broader database we seek to understand the morphology of the LLBL as it projects from the sub-solar region into the cusp. We will present preliminary results of our ongoing study.

Author

Magnetosheath; Tropical Regions; Interplanetary Magnetic Fields; Magnetic Field Reconnection

20080003827 NASA Glenn Research Center, Cleveland, OH, USA

Vision for Space Exploration

Smith, Bryan K.; 2006 NASA Seal/Secondary Air System Workshop; Volume 1; October 2007, pp. 39-57; In English; See also [20080003817](#); Original contains color illustrations; Copyright; Avail.: CASI: [A03](#), Hardcopy

Vision tasks include: a) Complete the International Space Station; b) Safely fly the Space Shuttle until 2010; c) Develop and fly the Crew Exploration Vehicle (by 2014); d) Return to the moon (by 2020); e) Sustained and affordable human and robotic program; f) Develop innovative technologies, knowledge, and infrastructures; and g) Promote international and commercial participation.

Derived from text

Space Exploration; International Space Station; Space Shuttles; Moon; Robotics

20080005206 NASA Glenn Research Center, Cleveland, OH, USA

Cratos: A Simple Low Power Excavation and Hauling System for Lunar Oxygen Production and General Excavation Tasks

Caruso, John J.; Greer, Lawrence C.; John, Wentworth T.; Spina, Dan C.; Krasowski, Mike J.; Abel, Phillip B.; Prokop, Norman F.; Flatico, Joseph M.; Sacksteder, Kurt R.; June 10, 2007; 9 pp.; In English; PTMSS Conference, 10-13 Jun. 2007, Sudbury, Ontario, Canada; Original contains color illustrations

Contract(s)/Grant(s): WBS 387498.04.01.01.03.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

The development of a robust excavating and hauling system for lunar and planetary excavation is critical to the NASA mission to the Moon and Mars. Cratos was developed as a low center of gravity, small (.75m x .75m x 0.3m), low power tracked test vehicle. The vehicle was modified to excavate and haul because it demonstrated good performance capabilities in a laboratory and field testing. Tested on loose sand in the SLOPE facility, the vehicle was able to pick up, carry, and dump sand, allowing it to accomplish the standard requirements delivery of material to a lunar oxygen production site. Cratos can pick up and deliver raw material to a production plant, as well as deliver spent tailings to a disposal site. The vehicle can complete many other In-Situ Resource Utilization (ISRU) excavation chores and in conjunction with another vehicle or with additional attachments may be able to accomplish all needed ISRU tasks.

Author

Excavation; Lunar Resources; Test Vehicles; Tracked Vehicles; Field Tests; Sands; Oxygen Production; Microgravity

20080005580 NASA Glenn Research Center, Cleveland, OH, USA

Lunar Dust: Characterization and Mitigation

Hyatt, Mark J.; Feighery, John; October 24, 2007; 16 pp.; In English; 9th International Conference on the Exploration and Utilization of the Moon/International Lunar Exploration Working Group, 22-27 Oct. 2007, Sorrento, Italy; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 092837.04.02.01.03; No Copyright; Avail.: CASI: [A03](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080005580>

Lunar dust is a ubiquitous phenomenon which must be explicitly addressed during upcoming human lunar exploration

missions. Near term plans to revisit the moon as a stepping stone for further exploration of Mars, and beyond, places a primary emphasis on characterization and mitigation of lunar dust. Comprised of regolith particles ranging in size from tens of nanometers to microns, lunar dust is a manifestation of the complex interaction of the lunar soil with multiple mechanical, electrical, and gravitational effects. The environmental and anthropogenic factors effecting the perturbation, transport, and deposition of lunar dust must be studied in order to mitigate its potentially harmful effects on exploration systems. The same hold true for assessing the risk it may pose for toxicological health problems if inhaled. This paper presents the current perspective and implementation of dust knowledge management and integration, and mitigation technology development activities within NASA's Exploration Technology Development Program. This work is presented within the context of the Constellation Program's Integrated Lunar Dust Management Strategy. This work further outlines the scientific basis for lunar dust behavior, its characteristics and potential effects, and surveys several potential strategies for its control and mitigation both for lunar surface operations and within the working volumes of a lunar outpost. The paper also presents a perspective on lessons learned from Apollo and forensics engineering studies of Apollo hardware.

Author

Lunar Dust; Regolith; Lunar Soil; Man Environment Interactions; Gravitational Effects; Lunar Exploration

20080005583 NASA Glenn Research Center, Cleveland, OH, USA

The Development of a Control System for a 5 Kilowatt Free Piston Stirling Space Convertor

Kirby, Raymond L.; Vitale, Nicholas; [2008]; 10 pp.; In English; Space Technology Applications International Forum (STAIF)-2008, 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): NNC06CB81C; WBS 463169.04.03.04.01.03; Copyright; Avail.: CASI: [A02](#), Hardcopy

The new NASA Vision for Exploration, announced by President Bush in January 2004, proposes an ambitious program that plans to return astronauts to the moon by the 2018 time frame. A recent NASA study entitled 'Affordable Fission Surface Power Study' recommended a 40 kWe, 900 K, NaK-cooled, Stirling conversion for 2020 launch. Use of two of the nominal 5 kW converters allows the system to be dynamically balanced. A group of four dual-converter combinations that would yield 40 kWe can be tested to validate the viability of Stirling technology for space fission surface power systems. The work described in this paper deals specifically with the control system for the 5 kW convertor described in the preceding paragraph. This control system is responsible for maintaining piston stroke to a setpoint in the presence of various disturbances including electrical load variations. Pulse starting of the FSPE convertor is also an inherent part of such a control system. Finally, the ability to throttle the engine to match the required output power is discussed in terms of setpoint control. Several novel ideas have been incorporated into the piston stroke control strategy that will engender a stable response to disturbances in the presence of midpoint drift while providing useful data regarding the position of both the power piston and displacer.

Author

Spacecraft Power Supplies; Stirling Cycle; Fission; Moon

20080006059 NASA Marshall Space Flight Center, Huntsville, AL, USA

Some Expected Mechanical Characteristics of Lunar Dust: A Geological View

Rickman, Doug; Street, Kenneth W.; [2008]; 7 pp.; In English; STAIF 2008, 10-14 Feb. 2008, Albuquerque, NM, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 092837.04.02.01.03; No Copyright; Avail.: CASI: [A02](#), Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006059>

The engineering properties of the lunar regolith reflect aspects of the original parent rock and the consequences of hypervelocity meteor bombardment. Compared to the Earth the geologic nature of the lunar regolith is quite distinct. On scales relevant to machinery, heterogeneity with respect to size and composition is much higher. But the total range in composition is much more restricted. Both facts have implications for predictions of properties, such as abrasion, which will be required by design engineers for constructing equipment for lunar use. Abrasion is related to hardness and hardness is a commonly measured property for both minerals and engineering materials. Although different hardness scales are routinely employed for minerals and engineering materials, a significant amount of literature is available relating the two. In this paper we discuss how to relate hardness to abrasion for the design of lunar equipment. We also indicate how abundant the various mineral phases are and typical size distributions for lunar regolith.

Author

Lunar Dust; Mineralogy; Mechanical Properties; Lunar Rocks; Regolith; Geology

20080006069 NASA Glenn Research Center, Cleveland, OH, USA

Advances in Space Traveling-Wave Tubes for NASA Missions

Wilson, Jeffrey D.; Wintucky, Edwin G.; Vaden, Karl R.; Force, Dale A.; Krainsky, Isay L.; Simons, Rainee N.; Robbins, Neal R.; Menninger, William L.; Dibb, Daniel R.; Lewis, David E.; Proceedings of the IEEE; October 2007; ISSN 0018-9219; Volume 95, No. 10, pp. 1958-1967; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 953033.01.03.44; Copyright; Avail.: Other Sources

ONLINE: <http://dx.doi.org/10.1109/JPROC.2007.905062>

Significant advances in the performance and reliability of traveling-wave tubes (TWTs) utilized in amplifying space communication signals for NASA missions have been achieved over the last three decades through collaborative efforts between NASA and primarily L-3 Communications Electron Technologies, Inc. (L-3 ETI). This paper summarizes some of the key milestones during this period and includes development of TWTs for the Communications Technology Satellite, Cassini, and Lunar Reconnaissance Orbiter missions. Technical advances in computer modeling, design techniques, materials, and fabrication have enabled power efficiency to increase by almost 40% and the output power/mass figure-of-merit to increase by an order of magnitude during this period.

Author

NASA Space Programs; Traveling Wave Tubes; Space Missions; Space Communication; Fabrication

20080006459 NASA Glenn Research Center, Cleveland, OH, USA

Lunar Resource Utilization: Development of a Reactor for Volatile Extraction from Regolith

Kleinhenz, Julie E.; Sacksteder, Kurt R.; Nayagam, Vedha; January 07, 2007; 6 pp.; In English; AIAA Aerospace Sciences Meeting and Exhibit, 7-10 Jan. 2008, Reno, NV, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 387498.04.01.03.01.03; Copyright; Avail.: CASI: A02, Hardcopy

The extraction and processing of planetary resources into useful products, known as In-Situ Resource Utilization (ISRU), will have a profound impact on the future of planetary exploration. One such effort is the RESOLVE (Regolith and Environment Science, Oxygen and Lunar Volatiles Extraction) Project, which aims to extract and quantify these resources. As part of the first Engineering Breadboard Unit, the Regolith Volatiles Characterization (RVC) reactor was designed and built at the NASA Glenn Research Center. By heating and agitating the lunar regolith, loosely bound volatiles, such as hydrogen and water, are released and stored in the reactor for later analysis and collection. Intended for operation on a robotic rover, the reactor features a lightweight, compact design, easy loading and unloading of the regolith, and uniform heating of the regolith by means of vibrofluidization. The reactor performance was demonstrated using regolith simulant, JSC1, with favorable results.

Author

Space Exploration; In Situ Resource Utilization; Oxygen; Regolith; Extraction; Lunar Rocks

20080006461 NASA Glenn Research Center, Cleveland, OH, USA

The Need for High Fidelity Lunar Regolith Simulants

Gaier, James R.; October 25, 2007; 17 pp.; In English; Space Resources Roundtable IV, 25-27 Oct. 2007, Golden, CO, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 936374.03.03.03; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: <http://hdl.handle.net/2060/20080006461>

The case is made for the need to have high fidelity lunar regolith simulants to verify the performance of structures and mechanisms to be used on the lunar surface. Minor constituents will in some cases have major consequences. Small amounts of sulfur in the regolith can poison catalysts, and metallic iron on the surface of nano-sized dust particles may cause a dramatic increase in its toxicity. So the definition of a high fidelity simulant is application dependent. For example, in situ resource utilization will require high fidelity in chemistry, meaning careful attention to the minor components and phases; but some other applications, such as the abrasive effects on suit fabrics, might be relatively insensitive to minor component chemistry. The lunar environment itself will change the surface chemistry of the simulant, so to have a high fidelity simulant at must be used in a high fidelity simulated environment to get a high fidelity simulation. Research must be conducted to determine how sensitive technologies will be to minor components and environmental factors before they can be dismissed as unimportant.

Author

Simulation; Lunar Rocks; Regolith; In Situ Resource Utilization; Toxicity; Lunar Surface; Lunar Environment; Dust; Sulfur

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 *Space Radiation*.

20080003845 NASA Marshall Space Flight Center, Huntsville, AL, USA

Early Hinode Observations of a Solar Filament Eruption

Sterling, Alphonse C.; Moore, Ronald L.; August 20, 2007; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We use Hinode X-Ray Telescope (XRT) and Solar Optical Telescope (SOT) filtergraph (FG) Stokes-V magnetogram observations to study the early onset of a solar eruption that includes an erupting filament that we observe in TRACE EUV images; this is one of the first filament eruptions seen with Hinode. The filament undergoes a slow rise for at least 30 min prior to its fast eruption and strong soft X-ray flaring, and the new Hinode data elucidate the physical processes occurring during the slow-rise period: During the slow-rise phase, a soft X-ray (SXR) sigmoid forms from apparent reconnection low in the sheared core field traced by the filament, and there is a low-level intensity peak in both EUV and SXRs during the slow rise. The SOT data show that magnetic flux cancellation occurs along the neutral line of the filament in the hours before eruption, and this likely caused the low-lying reconnection that produced the microflaring and the slow rise leading up to the eruption.

Author

Solar Optical Telescope; Solar Prominences; Coronal Mass Ejection; Solar Physics; X Ray Telescopes

20080003846 NASA Marshall Space Flight Center, Huntsville, AL, USA

New Evidence that CMEs are Self-Propelled Magnetic Bubbles

Moore, Ronald L.; Sterling, Alphonse C.; Seuss, Steven T.; August 20, 2007; 4 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: [A01](#), Hardcopy

We briefly describe the 'standard model' for the production of coronal mass ejections (CMEs), and our view of how it works. We then summarize pertinent recent results that we have found from SOHO observations of CMEs and the flares at the sources of these magnetic explosions. These results support our interpretation of the standard model: a CME is basically a self-propelled magnetic bubble, a low-beta plasmoid, that (1) is built and unleashed by the tether-cutting reconnection that builds and heats the coronal flare arcade, (2) can explode from a flare site that is far from centered under the full-blown CME in the outer corona, and (3) drives itself out into the solar wind by pushing on the surrounding coronal magnetic field.

Author

Bubbles; Coronal Mass Ejection; Standard Model (Particle Physics); SOHO Mission

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*.

20080005523 NASA Glenn Research Center, Cleveland, OH, USA

Degradation of Hubble Space Telescope Aluminized-Teflon Bi-Stem Thermal Shields

de Groh, Kim K.; Snyder, Aaron; Finlay, Katherine A.; [2008]; 17 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 698671.01.03.51; Copyright; Avail.: Other Sources

A section of the retrieved Hubble Space Telescope (HST) bi-stem thermal shields (BSTS), which experienced 8.25 years of space exposure, was analyzed for space environmental durability. The shields were comprised of 2 mil (0.051 mm) aluminized-Teflon fluorinated ethylene propylene (Al-FEP) rings fused together into a circular bellows shape. Because the circular thermal shields had solar, anti-solar and solar-grazing surfaces and were exposed to the space environment for a long duration, it provided a unique opportunity to study solar effects on the environmental degradation of Al-FEP, a commonly used spacecraft thermal control material. Therefore, the objective of this research was to characterize the degradation of retrieved HST BSTS Al-FEP with particular emphasis on solar effects. Data obtained included tensile properties, density (as-retrieved and after 200 C heating), solar absorptance, and surface morphology and chemistry. The solar facing surfaces of the thermal shields were found to be extremely embrittled and contained numerous through-thickness cracks. Tensile testing verified that near solar facing surfaces lost their mechanical strength and elasticity, while the anti-solar facing surfaces maintained their ductility. The density of the as-retrieved BSTS insulation was similar to pristine FEP. Heating at 200 C resulted in significant

increases in density for the solar facing BSTS indicating chain scission damage, consistent with the loss of mechanical strength and elongation. The solar absorptance of the solar-grazing and anti-solar facing surfaces were found to be similar to pristine BSTS, while the solar facing surfaces were found to have significantly increased solar absorptance. Both solar and anti-solar facing surfaces were microscopically textured from sweeping atomic oxygen erosion with the solar facing surface appearing to have a more pronounced texture in spite of being exposed to a lower atomic oxygen fluence indicating a possible solar/atomic oxygen synergistic effect. These results provide valuable information on space environmental degradation of Al-FEP, particularly with respect to solar radiation effects on embrittlement.

Author

Aluminum; Degradation; Hubble Space Telescope; Teflon (Trademark); Thermal Protection; Spacecraft Construction Materials; Heat Shielding; Extraterrestrial Radiation

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